

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



93 NO. 10  
531  
V.1

United States  
Department of  
Agriculture

Forest Service

National  
Forest  
System

January 1992



# Final Environmental Impact Statement

## on Management for the Northern Spotted Owl in the National Forests

### Volume 1



A

A  
B  
C  
C  
C  
d  
D  
E  
F



FORPLAN	Forest Planning Model
FSEIS	Final Supplement to the Environmental Impact Statement for the Pacific Northwest Region (Spotted Owl Guidelines, 1988)
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWS	U.S. Fish and Wildlife Service (USDI)
GIS	Geographic Information System
HCA	Habitat Conservation Area
ISC	Interagency Scientific Committee
IMPLAN	Forest Service Input-Output Economic Model
KV	Knutson - Vandenberg Act of 1924
MBF	Thousand Board Feet
MCF	Thousand Cubic Feet
MMBF	Million Board Feet
MMCF	Million Cubic Feet
MPA	Multiple-Pair Area
NEPA	National Environmental Policy Act of 1969
NFMA	National Forest Management Act of 1976
NPS	National Park Service (USDI)
NRF	Nesting, Roosting, and Foraging (Habitat)
PNW	Pacific Northwest Forest and Range Research Station (USDA)
PSW	Pacific Southwest Forest and Range Research Station (USDA)
R-5	Forest Service Pacific Southwest Region (CA)
R-6	Forest Service Pacific Northwest Region (WA and OR)
RNA	Research Natural Area
ROD	Record of Decision
SAS	Seattle Audubon Society
SOHA	Spotted Owl Habitat Area
TSPIRS	Timber Sale Program Information Reporting System
USDA	United States Department of Agriculture
USDI	United States Department of the Interior

In this environmental impact statement, any reference to "owl" or "spotted owl" refers to the northern spotted owl (*Strix occidentalis caurina*) unless specifically identified as another species or subspecies.

# Final Environmental Impact Statement

---

## on Management for the Northern Spotted Owl in the National Forests

States of Washington, Oregon,  
and California

Lead Agency

Forest Service  
U.S. Department of Agriculture



Responsible Official

Edward Madigan  
Secretary of Agriculture

For Further Information  
Contact

Jerald N. Hutchins  
Spotted Owl EIS Team Leader  
USDA-Forest Service  
P.O. Box 3623  
Portland, Oregon 97208  
(503) 326-7460

**DISCARDED**  
**PSW LIBRARY**

## Abstract

The Forest Service proposes to manage the National Forests for habitat that will ensure the viability of the northern spotted owl in National Forests in its range. Alternative A ("no-action") is the management direction given in the Regional Guides and Regional Guide Supplement. Alternative B (the proposed action and the preferred alternative) would adopt the Conservation Strategy of the Interagency Scientific Committee. Alternative C would adopt the Conservation Strategy and further apply its standards and guidelines for Habitat Conservation Areas to the Critical Habitat identified by the U.S. Fish and Wildlife Service in January 1992. Alternative D would adopt the Conservation Strategy and further apply its standards and guidelines for Habitat Conservation Areas to all existing northern spotted owl nesting, roosting, and foraging habitat. Alternative E would adopt the Multi-Resource Strategy developed by a committee subgroup of the National Forest Products Association and American Forest Council which proposes a different set of standards and guidelines and conservation areas.

## Notice

Readers should note that the Secretary of Agriculture is the responsible official for this proposed action. This means that no administrative review ("appeal") will be available on the Record of Decision through the process specified in 36 CFR 217.

# Table of Contents

---

## Volume 1

Summary . . . . .	S-1
Chapter 1. Purpose and Need . . . . .	1-1
Chapter 2. The Alternatives	
Alternative A (SOHAs) . . . . .	2-5
Elements Common to Alternatives B, C, and D . . . . .	2-19
Alternative B (Proposed Action) . . . . .	2-39
Alternative C (ISC Conservation Strategy and Critical Habitat) . . . . .	2-41
Alternative D (ISC Conservation Strategy and All Nesting, Roosting, and Foraging Habitat . . . . .	2-43
Alternative E (Multi-Resource Strategy) . . . . .	2-45
Comparison of the Alternatives . . . . .	2-57
Alternatives Eliminated from Detailed Study . . . . .	2-73
Chapters 3&4. The Affected Environment and Environmental Consequences	
The Northern Spotted Owl . . . . .	3&4-3
The Northern Spotted Owl . . . . .	3&4-3
Habitat Definitions . . . . .	3&4-11
Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat . . . . .	3&4-19
Population Biology . . . . .	3&4-33
Population Viability . . . . .	3&4-39
Assessing the Alternatives . . . . .	3&4-51
Overall Viability Rating for the Alternatives . . . . .	3&4-93
The Forests, Their Management, and Their Resources . . . . .	3&4-101
Forest and Timber Management . . . . .	3&4-101
Pacific Yew ( <i>Taxus brevifolia</i> ) . . . . .	3&4-121
Insects and Diseases . . . . .	3&4-122
Fire and Fuels Management . . . . .	3&4-124
Old-Growth Forests . . . . .	3&4-125
Wildlife . . . . .	3&4-135
Threatened and Endangered Species . . . . .	3&4-143
Water Quality and Fish Habitat . . . . .	3&4-153
Soils . . . . .	3&4-158
Land Adjustment, Uses, and Permits . . . . .	3&4-159
Mineral and Energy Resources . . . . .	3&4-160
Recreation . . . . .	3&4-164
Transportation System - Forest Roads . . . . .	3&4-167

People and the Forests . . . . .	3&4-169
Timber Market Effects . . . . .	3&4-171
Employment and Income . . . . .	3&4-183
Revenues . . . . .	3&4-197
Payments to Counties . . . . .	3&4-203
Economic Factors Other Than Timber . . . . .	3&4-211
Non-Market Contribution . . . . .	3&4-214
Social and Community Effects . . . . .	3&4-217
Minorities, Women, and Civil Rights . . . . .	3&4-228
Cultural Resources . . . . .	3&4-229
American Indian Religious Sites . . . . .	3&4-230
Adverse and Long-Term Consequences . . . . .	3&4-231

## Pre-Appendices

List of Preparers
Distribution List
Index
Glossary
Bibliography

## Volume 2

### Appendices

Appendix A -- Public Involvement . . . . .	A-1
Appendix B -- Analytical Models . . . . .	B-1
Appendix C -- Management of Other Lands . . . . .	C-1
Appendix D -- Annotated Bibliography . . . . .	D-1
Appendix E -- Related Activities . . . . .	E-1
Appendix F -- Fire and Fuels Management . . . . .	F-1
Appendix G -- Insects and Diseases . . . . .	G-1
Appendix H -- Land Adjustment . . . . .	H-1
Appendix I -- Pacific Yew . . . . .	I-1
Appendix J -- Monitoring Plan . . . . .	J-1
Appendix K -- Multi-Resource Strategy . . . . .	K-1
Appendix L -- Response to Public Comments . . . . .	L-1
Appendix M -- Biological Opinion . . . . .	M-1

# List of Tables

---

## Summary

Table S-1	Acres Suitable for Timber Production, by Alternative . . . . .	S-26
Table S-2	Average Annual Allowable Sale Quantity (ASQ) . . . . .	S-26

## Chapter 2

Table 2-1	Acres Suitable for Timber Production by Alternative . . . . .	2-66
Table 2-2	Average Annual Allowable Sale Quantity (ASQ) . . . . .	2-66

## Chapter 3&4

Table 3&4- 1	Range of the Northern Spotted Owl . . . . .	3&4-7
Table 3&4- 2	National Forests by Physiographic Provinces . . . . .	3&4-9
Table 3&4- 3	Acres of Habitat Within the Range on National Forests . . . . .	3&4-15
Table 3&4- 4	Median Annual Home Range . . . . .	3&4-18
Table 3&4- 5	Habitat Acres and Owl Pairs on All Lands . . . . .	3&4-21
Table 3&4- 6	Potential Change in Owl Habitat, Alternative A . . . . .	3&4-54
Table 3&4- 7	Potential Change in Owl Habitat, Alternative B . . . . .	3&4-56
Table 3&4- 8	Potential Change in Owl Habitat, Alternative C . . . . .	3&4-58
Table 3&4- 9	Potential Change in Owl Habitat, Alternative D . . . . .	3&4-60
Table 3&4-10	Potential Change in Owl Habitat, Alternative E . . . . .	3&4-62
Table 3&4-11	Potential Change in Owl Habitat by Alternative, Criterion 1 . . . . .	3&4-64
Table 3&4-12	Areas of Concern, Alternative A . . . . .	3&4-66
Table 3&4-13	Areas of Concern, Alternative B . . . . .	3&4-67
Table 3&4-14	Areas of Concern, Alternative C . . . . .	3&4-68
Table 3&4-15	Areas of Concern, Alternative D . . . . .	3&4-69
Table 3&4-16	Areas of Concern, Alternative E . . . . .	3&4-71
Table 3&4-17	Habitat Capability by Alternative . . . . .	3&4-75
Table 3&4-18	Spacing by Alternative, Criterion 5 . . . . .	3&4-83
Table 3&4-19	Clustering, Alternative B . . . . .	3&4-88
Table 3&4-20	Clustering, Alternative C . . . . .	3&4-88
Table 3&4-21	Clustering, Alternative E . . . . .	3&4-90
Table 3&4-22	Timber Production Acres and ASQ, Alternative A . . . . .	3&4-102
Table 3&4-23	Historic Timber Harvest Levels from National Forests . . . . .	3&4-102
Table 3&4-24	Forested Acres Suitable for Timber Production . . . . .	3&4-109
Table 3&4-25	Area to be Managed for Timber Production . . . . .	3&4-110
Table 3&4-26	First Decade Timber Program . . . . .	3&4-111
Table 3&4-27	Estimates of Old-Growth Acres . . . . .	3&4-128
Table 3&4-28	Old-Growth Acres Suitable for Timber Production . . . . .	3&4-130
Table 3&4-29	Estimate of Old-Growth Acres Remaining . . . . .	3&4-132
Table 3&4-30	Species Closely Associated with Late-Successional Forests . . . . .	3&4-136

Table 3&4-31	Other Listed Threatened and Endangered Species . . . . .	3&4-144
Table 3&4-32	Occupied Marbled Murrelet Sites . . . . .	3&4-150
Table 3&4-33	Winter Sports Areas . . . . .	3&4-166
Table 3&4-34	Historic Timber Harvest Levels . . . . .	3&4-191
Table 3&4-35	Historic Employment Levels . . . . .	3&4-192
Table 3&4-36	Historic Income Levels . . . . .	3&4-193
Table 3&4-37	Projected Total Employment . . . . .	3&4-194
Table 3&4-38	Projected Income . . . . .	3&4-195
Table 3&4-39	Projected Employment Generated from Timber Harvest . .	3&4-196
Table 3&4-40	Historic Revenue Levels . . . . .	3&4-199
Table 3&4-41	Projected Total Revenues . . . . .	3&4-200
Table 3&4-42	Projected Net Revenues . . . . .	3&4-201
Table 3&4-43	Historic Payments to Counties . . . . .	3&4-207
Table 3&4-44	Projected Payments to Counties . . . . .	3&4-208
Table 3&4-45	Estimated Existence Value . . . . .	3&4-216

# List of Figures

---

## Summary

Figure S-1	Range of the Northern Spotted Owl Within the United States . . . . .	S-4
Figure S-2	Alternative A . . . . .	S-11
Figure S-3	Alternative B . . . . .	S-12
Figure S-4	Alternative C . . . . .	S-13
Figure S-5	Alternative D . . . . .	S-14
Figure S-6	Alternative E . . . . .	S-15
Figure S-7	Historic and Projected Employment . . . . .	S-29
Figure S-8	Historic and Projected Income . . . . .	S-29
Figure S-9	Historic and Projected Revenues . . . . .	S-29
Figure S-10	Historic and Projected Payments to Counties . . . . .	S-29

## Chapter 2

Figure 2-1	Historic and Projected Employment . . . . .	2-69
Figure 2-2	Historic and Projected Income . . . . .	2-69
Figure 2-3	Historic and Projected Revenues . . . . .	2-69
Figure 2-4	Historic and Projected Payments to Counties . . . . .	2-69

## Chapter 3&4

Figure 3&4- 1	Range of the Northern Spotted Owl Within the United States . . . . .	3&4-6
Figure 3&4- 2	National Forests by Physiographic Province . . . . .	3&4-8
Figure 3&4- 3	Changes in Owl Habitat, 1800 to Present . . . . .	3&4-20
Figure 3&4- 4	Areas of Concern . . . . .	3&4-30
Figure 3&4- 5	Reported Northern Spotted Owl Pairs . . . . .	3&4-34
Figure 3&4- 6	Abundance of Owls in Relation to Habitat . . . . .	3&4-44
Figure 3&4- 7	Owl Habitat Over Time by Alternative . . . . .	3&4-64
Figure 3&4- 8	Distribution for the Olympic Peninsula Area of Concern by Alternative, Criterion 2 . . . . .	3&4-72
Figure 3&4- 9	Distribution for the Oregon Coast Range Area of Concern by Alternative, Criterion 2 . . . . .	3&4-72
Figure 3&4-10	Distribution for All Areas of Concern by Alternative, Criterion 2 . . . . .	3&4-72
Figure 3&4-11	Cluster Size of Designated Areas, Alternative B . . . . .	3&4-91
Figure 3&4-12	Cluster Size of Designated Areas, Alternative C . . . . .	3&4-91
Figure 3&4-13	Cluster Size of Designated Areas, Alternative E . . . . .	3&4-91
Figure 3&4-14	Relationship of Suitable Timber Acres to ASQ . . . . .	3&4-105
Figure 3&4-15	Alternative B, ASQ as a Percent of Alternative A . . . . .	3&4-112
Figure 3&4-16	Alternative C, ASQ as a Percent of Alternative A . . . . .	3&4-113

Figure 3&4-17	Alternative D, ASQ as a Percent of Alternative A . . . . .	3&4-114
Figure 3&4-18	Alternative E, ASQ as a Percent of Alternative A . . . . .	3&4-115
Figure 3&4-19	Alternatives B and C, Effect of 50-11-40 . . . . .	3&4-117
Figure 3&4-20	Old-Growth Forest Inventory . . . . .	3&4-133
Figure 3&4-21	Recreation Opportunity Spectrum . . . . .	3&4-164
Figure 3&4-22	Projected Domestic Lumber Production . . . . .	3&4-172
Figure 3&4-23	Projected Lumber Imports from Canada . . . . .	3&4-174
Figure 3&4-24	Historic Stumpage Prices by Economic Region . . . . .	3&4-176
Figure 3&4-25	Projected Stumpage Prices - West Side . . . . .	3&4-177
Figure 3&4-26	Projected Stumpage Prices - East Side . . . . .	3&4-178
Figure 3&4-27	Projected Stumpage Prices - California . . . . .	3&4-178
Figure 3&4-28	Pistoric Timber Harvest by Ownership . . . . .	3&4-179
Figure 3&4-29	Projected Timber Harvests from National Forests . . . . .	3&4-180
Figure 3&4-30	Projected Forest Industry Timber Harvests . . . . .	3&4-181
Figure 3&4-31	Projected Other Private Timber Harvests . . . . .	3&4-182
Figure 3&4-32	Historic Employment Levels . . . . .	3&4-192
Figure 3&4-33	Historic Income Levels . . . . .	3&4-193
Figure 3&4-34	Projected Total Employment . . . . .	3&4-194
Figure 3&4-35	Projected Income . . . . .	3&4-195
Figure 3&4-36	Historic Revenue Levels . . . . .	3&4-199
Figure 3&4-37	Projected Total Revenues . . . . .	3&4-200
Figure 3&4-38	Historic Payments to Counties . . . . .	3&4-209
Figure 3&4-39	Projected Total Payments to Counties . . . . .	3&4-209

# Summary

The Forest Service has prepared an environmental impact statement to disclose the environmental consequences of five different management alternatives to provide habitat for the northern spotted owl in National Forests. Four of these alternatives would amend the Regional Guides and approved Forest Plans for the Pacific Northwest Region and the Pacific Southwest Region of the Forest Service.

## **The Proposed Action**

The proposed action is to manage National Forests within the range of the northern spotted owl in accordance with the Interagency Scientific Committee's report "A Conservation Strategy for The Northern Spotted Owl". This proposed action would apply only to lands administered by the Forest Service.

## **Record of Decision**

Although Alternative B (which would adopt the Interagency Scientific Committee's Conservation Strategy) is designated as the preferred alternative, the final decision is yet to be made. The Record of Decision will not be signed sooner than March 2, 1992, thirty days after the Notice of Availability of this Final Environmental Impact Statement is printed in the Federal Register.

The Secretary of Agriculture, Edward Madigan, is the responsible official for this action. This means that no administrative review ("appeal") will be available on the Record of Decision through the Forest Service process specified in 36 CFR 217.

The public is welcome to provide any additional comments on this environmental impact statement. It is not necessary to resubmit comments made during the Draft Environmental Impact Statement comment period.

## *Summary*

Written comments relative to the Final Environmental Impact Statement or the Record of Decision may be sent to:

Spotted Owl EIS Team  
USDA Forest Service  
P.O. Box 3623  
333 First Avenue  
Portland, Oregon 97208

## **Public Comments**

The USDA Forest Service published a Draft Environmental Impact Statement in late September 1991. The public was afforded three months in which to submit comments relative to that Draft. During that time the Forest Service held public hearings in Olympia, Washington; Salem, Oregon; and Redding, California to facilitate public comment. About 150 people presented testimony at those hearings. Most of the public comment was received through the mail. Over 5,000 pieces of mail commenting on the Draft were received prior to the December 27, 1991, comment deadline.

Public comments resulted in several changes in the Final Environmental Impact Statement. The most significant change is the inclusion of a new alternative – Alternative E – based on the Multi-Resource Strategy offered by the National Forest Products Association and the American Forest Council. This alternative was analyzed in the same manner as other alternatives.

For more information on public comment and response refer to Appendix L of this environmental impact statement.

## **This Environmental Impact Statement**

The Forest Service is preparing this environmental impact statement to comply with a court order issued on May 23, 1991, by U.S. District Court Judge William L. Dwyer, "to submit to the court and have in effect by March 5, 1992 revised standards and guidelines to ensure the northern spotted owl's viability, together with an environmental impact statement, as required by NFMA and its implementing regulations."

## **Earlier Strategies**

This is not the first time the Forest Service and other resource management agencies have addressed the issue of spotted owl habitat management in an environmental impact statement or similar planning documents. In fact, this environmental impact statement relies heavily on earlier documents such as:

- the Interagency Scientific Committee (the “Thomas Committee”) Report: A Conservation Strategy for the Northern Spotted Owl that was issued in May 1990;
- the Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide issued in 1988; and
- the Regional Guide for the Pacific Southwest Region issued in August, 1984.

**Implementation** On National Forests with lands within the spotted owl’s range, the Regional Guides and Forest Plans will be amended by the Record of Decision for this environmental impact statement with the standards and guidelines and designated areas presented in the selected alternative. Projects will be conducted under the standards and guidelines of the selected alternative. Standards and guidelines and management direction in Forest Plans not directly superseded by the selected alternative will remain in effect. The annual quantity of timber offered for sale will reflect the harvest implications of the standards and guidelines and the designated areas of the alternative selected.

On those National Forests without approved Forest Plans, the standards and guidelines and designated areas will apply directly to projects and will be incorporated into the Forest Plans which are being developed.

The U.S. Fish and Wildlife Service is expected to issue a Recovery Plan for the Northern Spotted Owl by mid-1992. When Forest Service objectives under the Recovery Plan have been identified, each affected National Forest will be directed to reevaluate the effect of management direction for the northern spotted owl on Forest-level programs and evaluate the need to amend or to revise its Forest Plan.

## Where

These alternatives apply to the lands administered by the Forest Service within the range of the northern spotted owl. The range of the northern spotted owl is shown on the following map (see Figure S – 1).

## Summary

### Figure S – 1 Range of the Northern Spotted Owl Within the United States



## Issues

---

For over a decade there has been growing controversy over managing the National Forests for the northern spotted owl, and the problem is more complex than the conflict of “owls vs. jobs.” The interdisciplinary team’s review of past documents, public comments, court cases, media reports and features, and the concerns of Forest Service managers led to this description of the principal issues. These issues serve to focus the comparison of the alternatives.

The northern spotted owl is listed under the Endangered Species Act of 1973 as threatened with extinction as a subspecies by the U.S. Fish and Wildlife Service. The long-term viability of the spotted owl depends on adequate, well distributed habitat for all of its life functions.

The set of factors affecting long-term viability of the northern spotted owl are complex and not precisely known. While most people want to see the spotted owl survive, there is disagreement over what populations should be provided for and the forest management that will ensure long-term survival.

A forest ecological system is complex and varied. Managing to preserve and enhance spotted owl habitat has major implications for the overall structure and function of the entire forest, for other wildlife species, the water quality in streams and rivers, the appearance of the forest, and the age, quality, and composition of its plant and animal communities.

Species which need young forests and species which need old forests are affected by changes in the age, composition, and distribution of forest areas. Management to provide the diversity of the forest’s structure and function is itself an issue. The spotted owl was selected as an indicator for other species and many people see it as a surrogate for old-growth stands and other old-growth related species. It has become a stand-in in the debate over how the National Forests should be managed. The management of habitat for the northern spotted owl will affect many other wildlife species and the old-growth forest ecological systems themselves.

## Summary

Timber management has been a major part of the Forest Service's role of actively managing the National Forests for a variety of sustainable benefits for the Nation. The timber management program on the National Forests within the range of the spotted owl has focused on harvesting older forest areas for timber and replacing them with faster growing young stands. Since older forest areas are central to the spotted owl's habitat, this part of the timber management program impacts spotted owl habitat and the viability of this subspecies.

Managing the National Forests to provide habitat for a viable population of northern spotted owls may result in a change in the extent and rate of the harvest of older forest areas, as well as major changes to how other forest areas are managed. The design, implementation, and effects of those changes are controversial.

The logs and other wood from the Forest Service's timber management program are crucial raw material for the wood products industry and, after milling, serve the needs of a variety of consumers. The wood products industry's principal employment is located in small cities and towns, and in rural areas. Additionally, a quarter of the receipts from timber sales go to county governments for roads and schools.

Reductions in the amount of timber sold for harvest have direct effects on the employment and economic health of the forestry and wood products industries. These immediately affect the economic vitality of the communities dependent on them, and the well being of workers and families. The viability of some of these communities and their institutions will be threatened.

There are other human uses of the National Forests that will be enhanced, maintained or curtailed in managing habitat for the spotted owl. Road construction and use, recreation, mining, and other land uses might all be affected. There may be alternate paths for people and communities to take to adjust to changes. The effectiveness of those paths, and the human costs and benefits of making those changes, is open to question.

## **The Alternatives**

---

Each alternative is a plan for managing habitat for the northern spotted owl on the National Forests. Each consists of different designated areas managed primarily for spotted owl habitat, standards and guidelines for those areas and the surrounding forest, and directions for implementation, monitoring, and adjustment.

### **Consultation**

Consultation and conferencing under Section 7(a) of the Endangered Species Act with the U.S. Fish and Wildlife Service was conducted for the preferred alternative. The U.S. Fish and Wildlife Service's biological opinion on Alternative B was a "no jeopardy" opinion. This opinion was received on December 18, 1991, and appears in Appendix M of this environmental impact statement.

### **Critical Habitat**

In January 1992 the U.S. Fish and Wildlife Service determined the lands that are Critical Habitat for the northern spotted owl. (These lands are presented as Critical Habitat Units on the map for Alternative C in this environmental impact statement.)

Regardless of which alternative is selected in the Record of Decision, the Forest Service will prevent the adverse destruction or modification of Critical Habitat. The appropriateness of a proposed action in Critical Habitat will be determined through consultation with the U.S. Fish and Wildlife Service according to section 7(a) of the Endangered Species Act

### **Monitoring**

Monitoring is an essential component of managing for the northern spotted owl. All the alternatives would, as they are implemented, monitor three crucial aspects of the management plan. The monitoring will provide information to determine if the standards and guidelines are implemented consistently, to verify whether they are having the predicted effect, and to determine if key underlying assumptions are sound. The Monitoring Plan is presented in Appendix J of this environmental impact statement.

## *Summary*

### **Mitigation and Resource Management Direction**

“Mitigation” refers to measures that avoid, minimize, compensate for, or rectify adverse environmental effects. In this environmental impact statement, Alternative A would implement the Regional Guides, Forest Plans, and other resource management direction. All of this existing management direction has environmental and resource mitigation as an integral part. The other four Alternatives (B, C, D, and E) retain all of the mitigation measures and standards and guidelines of the existing land and resource management direction except for that directly superseded by the designated areas and standards and guidelines for these alternatives.

Direction to manage and protect the environment and resources of the National Forests is in place; these alternatives add to that direction. This environmental impact statement adds no additional direction for resources other than for the management of spotted owl habitat.

Measures to mitigate potential adverse environmental impacts on other resources are in place; this environmental impact statement proposes no additional mitigation for other resources apart from the direction for managing habitat for the northern spotted owl.

### **Standards and Guidelines and Designated Areas**

The standards and guidelines that would guide activities in the spotted owl habitat in National Forests for each alternative are presented in full in Chapter 2 of the Final Environmental Impact Statement. The following is a very brief summary of the primary standards and guidelines that would apply to designated areas managed primarily for spotted owl habitat in this environmental impact statement.

#### **Spotted Owl Habitat Areas (SOHAs)**

Spotted Owl Habitat Areas (SOHAs) were established in the Regional Guides (as amended) for the two Forest Service Regions that include Washington, Oregon, and California. SOHAs range from 3,000 acres on the Olympic Peninsula to 1,000 acres in southern Oregon and in California. SOHAs are to be managed to maintain habitat for spotted owls now and over the long term, using silvicultural activities that best fit local conditions. Alternative A would implement the SOHA strategy.

### **Habitat Conservation Areas (HCAs)**

Habitat Conservation Areas (HCAs) are large blocks of habitat to support multiple pairs of spotted owls. HCAs were identified by the Interagency Scientific Committee in their Conservation Strategy. Ideally, HCAs support 20 or more pairs of spotted owls. Most HCAs are over 25,000 acres in size. Smaller HCAs are also established around known owl pairs where habitat conditions do not permit or require the larger HCAs. HCAs are a main habitat component of Alternatives B, C, and D.

There are a number of management requirements for HCAs, most of which limit resource development in order to preserve the type and quality of habitat needed by the spotted owl. No timber harvest is permitted in HCAs, and other development activity is restricted.

### **Multiple-Pair Areas (MPAs)**

Multiple-Pair Areas (MPAs) in Alternative E are large blocks of habitat to support multiple pairs of spotted owls. Ideally, MPAs support 20 or more pairs of owls. There is a chain of Reserved and Deferred MPAs along much of the National Forest in the range of the spotted owl, where resource development is limited to preserve owl habitat. Research MPAs are also designated in Alternative E to evaluate silvicultural treatments on spotted owl habitat. Some timber harvest may occur in Research MPAs.

### **Critical Habitat Units**

In January 1992 the U.S. Fish and Wildlife Service issued their final Critical Habitat decision for the northern spotted owl. No particular management regime was prescribed by the U.S. Fish and Wildlife Service for Critical Habitat. Alternative C in this document extends the standards and guidelines of the HCAs to Critical Habitat.

### **Nesting, Roosting, and Foraging Habitat**

As the name indicates, this is habitat that has the characteristics known to be most suitable for northern spotted owl nesting, roosting, and foraging. It is generally mature and old-growth forest stands characterized by large coniferous trees (over 30 inches in diameter), 60 to 80 percent canopy closure, broken tops and cavities in the large live trees, and numerous large snags and logs. Alternative D in this document extends the standards and guidelines of the HCAs to all nesting, roosting, and foraging spotted owl habitat in the National Forests.

## Summary

### Dispersal Habitat

Dispersal habitat is used by spotted owls to move to new areas. Dispersal habitat is important in assuring a well distributed population and avoiding the isolation of small populations.

Alternative A makes no special provision for dispersal habitat.

**The “Forest Matrix”.** In Alternatives B, C, and D the forest outside HCAs is called the “Forest Matrix”. The Interagency Scientific Committee determined that to assure viability of the spotted owl, these lands that are suited for timber production must be managed using “the 50-11-40 rule”.

**“The 50-11-40 Rule”.** This rule states that in each quarter township (nine square miles) 50 percent of the forest must be maintained in (or managed to achieve) stands where the trunk diameter (breast high) of the trees is 11 inches or more, and the forest canopy is closed over at least 40 percent of the area.

**Connecting Habitat.** Alternative E uses a combination of Connecting Habitat and “the 40-20’-40” rule to provide dispersal habitat for the spotted owl. Connecting Habitat forms corridors between Deferred and Reserved MPAs and are managed for 30 to 50 percent nesting, roosting, and foraging habitat. The California National Forests in the northern spotted owl’s range and on the southern part of the Siuslaw National Forest are managed as Connecting Habitat outside of MPAs.

**“The 40-20’-40 Rule”.** Most of the remainder of the forest in the Oregon and Washington Cascades and the Klamath Mountains of Oregon is in an ”Owl Management Zone“ and managed under “the 40-20’-40 rule “. This rule requires maintenance of 40 percent canopy closure over 40 percent of each watershed, with the bottoms of tree crowns averaging at least 20 feet above the forest floor.

## The Five Alternatives

Here are brief descriptions of the five alternatives that were studied in detail. A representative map illustrating the nature of the designated areas accompanies each. Full descriptions of Alternatives A through E, and the standards and guidelines that would apply to the National Forests, are in Chapter 2 of the Final Environmental Impact Statement.

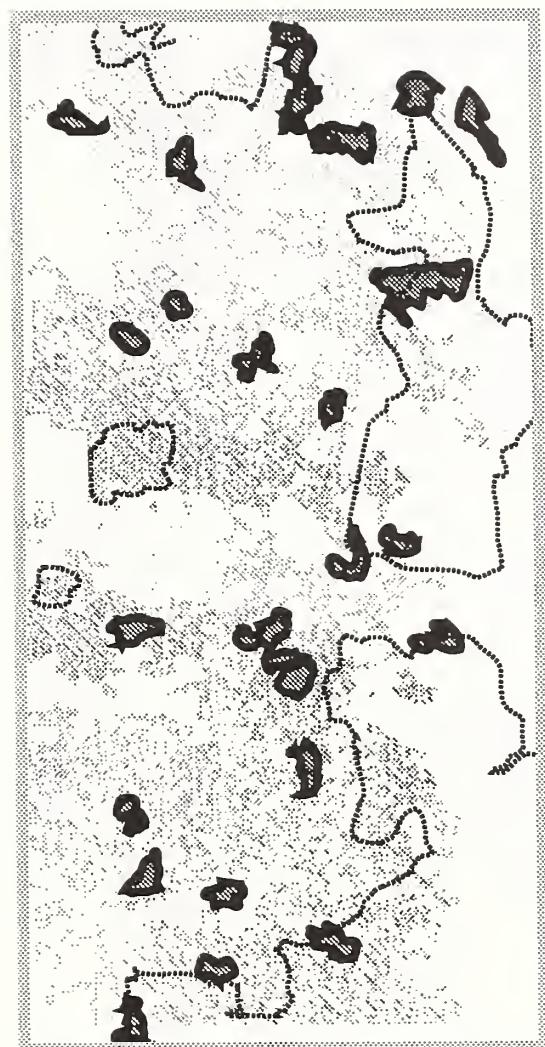
**Figure S – 2 Alternative A  
(No Action)**

**Spotted Owl Habitat Areas  
(SOHAs)**

Alternative A would manage the National Forests as directed in the Regional Guides and Forest Plans. Those guides and plans prescribe management areas known as Spotted Owl Habitat Areas (SOHAs) for spotted owl habitat.

The term "no action" does not imply that no action would be taken to manage spotted owl habitat, rather this alternative is called "no action" because it meets the Council of Environmental Quality's requirements for a "no-action" alternative required in environmental impact statements.

Representation of designated areas managed primarily for spotted owl habitat in Alternative A, Spotted Owl Habitat Areas (SOHAs).



**Legend**

Designated areas managed primarily for spotted owl habitat



Northern spotted owl nesting, roosting, and foraging habitat



Reserved Lands (e.g., Wilderness and National Monuments)



Spotted Owl Habitat Area (SOHA)



Habitat Conservation Area (HCA)



Not applicable to this alternative

Critical Habitat Unit (CHU)



Not applicable to this alternative

Reserved and Deferred Multiple Pair Areas



Not applicable to this alternative

Research Multiple Pair Areas



Not applicable to this alternative

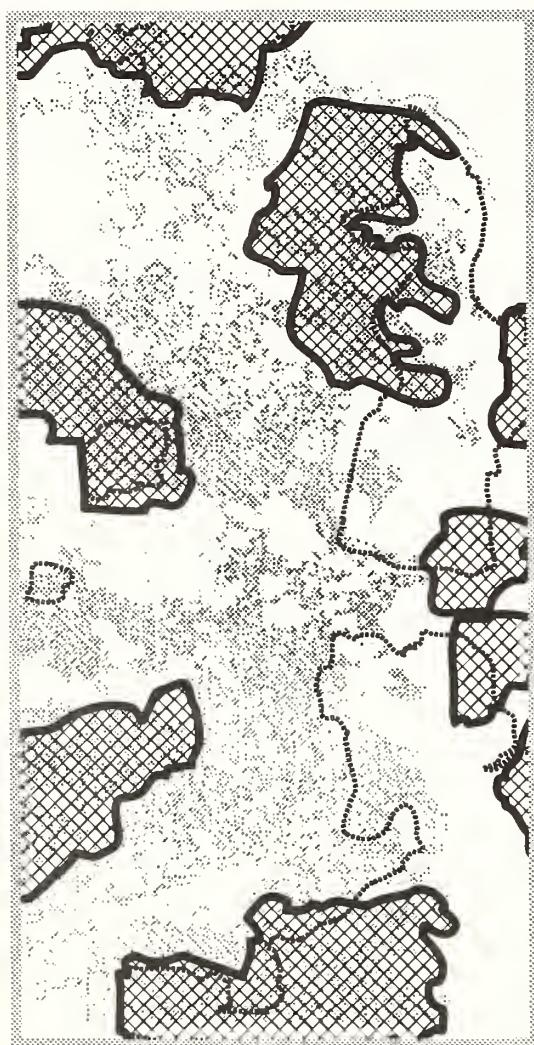
Connecting Habitat



Not applicable to this alternative

## Summary

**Figure S – 3 Alternative B  
(Proposed Action)**



### Interagency Scientific Committee (ISC) Conservation Strategy

Alternative B is the preferred alternative for this environmental impact statement.

This alternative would apply the Conservation Strategy presented by the Interagency Scientific Committee in their 1990 report "A Conservation Strategy for the Northern Spotted Owl" to National Forests within the range of the northern spotted owl.

The Habitat Conservation Areas (HCAs) designated by the Interagency Scientific Committee on the National Forests would be managed to comply with the standards and guidelines in their report. Timber harvest would be very limited and other development activity restricted in HCAs. The National Forest outside the HCAs that is suitable for timber production would be managed to maintain or achieve the standard of the 50-11-40 rule.

Representation of designated areas managed primarily for spotted owl habitat in Alternative B, Habitat Conservation Areas (HCAs).

## Legend

Designated areas managed primarily for spotted owl habitat



Northern spotted owl nesting, roosting, and foraging habitat



Reserved Lands (e.g., Wilderness and National Monuments)



Spotted Owl Habitat Area (SOHA)



Not applicable to this alternative

Habitat Conservation Area (HCA)



Critical Habitat Unit (CHU)



Not applicable to this alternative

Reserved and Deferred Multiple Pair Areas



Not applicable to this alternative

Research Multiple Pair Areas



Not applicable to this alternative

Connecting Habitat



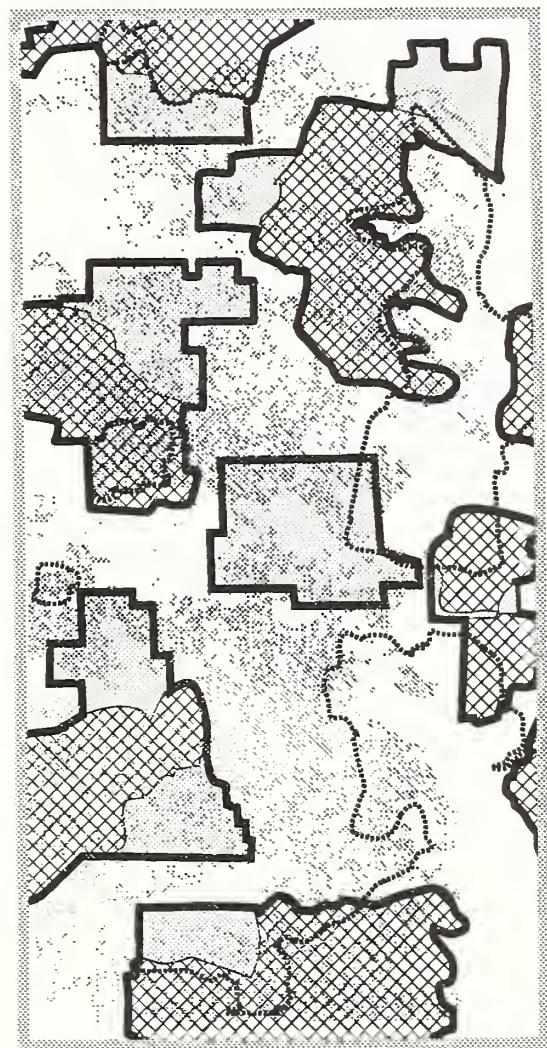
Not applicable to this alternative

Figure S – 4 Alternative C

### ISC Conservation Strategy Plus Critical Habitat Units

This alternative adopts the Conservation Strategy presented by the Interagency Scientific Committee and further applies it to the Critical Habitat identified by the U.S. Fish and Wildlife Service in their January 1992 rule. Timber harvest would be very limited and other development activity restricted in HCAs and in Critical Habitat. The National Forest outside the HCAs and Critical Habitat that is suitable for timber production would be managed to maintain or achieve the standard of the 50-11-40 rule.

Representation of designated areas managed primarily for spotted owl habitat in Alternative C, HCAs plus Critical Habitat Units (CHUs).



### Legend

Designated areas managed primarily for spotted owl habitat



Northern spotted owl nesting, roosting, and foraging habitat



Reserved Lands (e.g., Wilderness and National Monuments)



Spotted Owl Habitat Area (SOHA)



Not applicable to this alternative

Habitat Conservation Area (HCA)



Critical Habitat Unit (CHU)



Reserved and Deferred Multiple Pair Areas



Not applicable to this alternative

Research Multiple Pair Areas



Not applicable to this alternative

Connecting Habitat

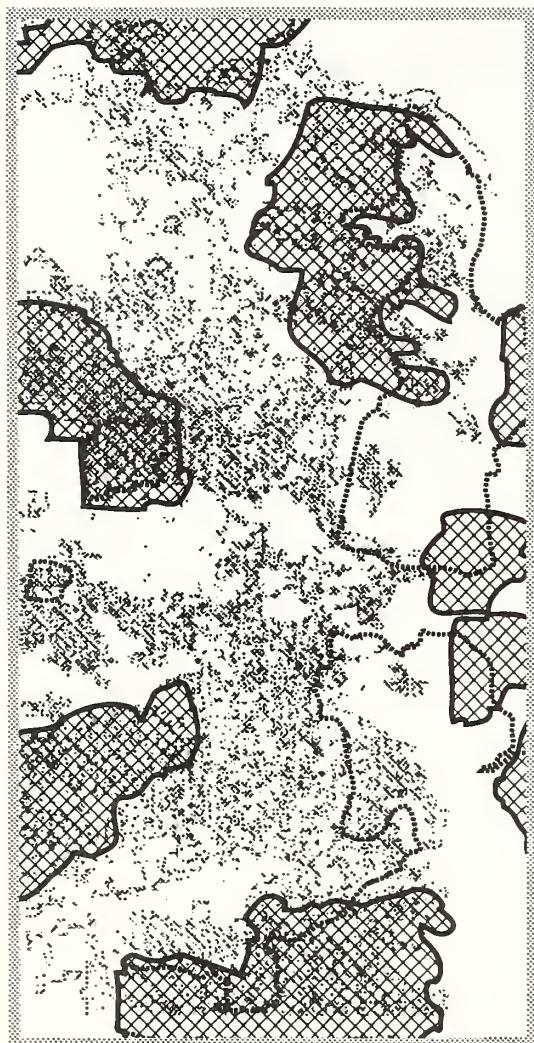


Not applicable to this alternative

## Summary

**Figure S – 5 Alternative D**

### ISC Conservation Strategy Plus All Owl Habitat



This alternative adopts the Conservation Strategy presented by the Interagency Scientific Committee and further applies it to all northern spotted owl nesting, roosting, and foraging habitat. Timber harvest would be very limited and other development activity restricted in HCAs and in all nesting, roosting, and foraging habitat. Habitat that is suitable for timber production would be managed to maintain or achieve the standard of the 50-11-40 rule.

For this alternative only, all northern spotted owl nesting, roosting, and foraging habitat (the gray areas on this map) is considered to be included within the designated area managed primarily for spotted owl habitat. The small size and wide distribution of the many forest stands comprising spotted owl nesting, roosting, and foraging habitat does not allow accurate depiction at this scale.

Representation of designated areas managed primarily for spotted owl habitat in Alternative D, HCAs plus all nesting, roosting, and foraging habitat.

## Legend

Designated areas managed primarily for spotted owl habitat



Northern spotted owl nesting, roosting, and foraging habitat



In this alternative, all is designated area managed primarily for spotted owl habitat

Reserved Lands (e.g., Wilderness and National Monuments)



Spotted Owl Habitat Area (SOHA)



Not applicable to this alternative

Habitat Conservation Area (HCA)



Critical Habitat Unit (CHU)



Not applicable to this alternative

Reserved and Deferred Multiple Pair Areas



Not applicable to this alternative

Research Multiple Pair Areas



Not applicable to this alternative

Connecting Habitat



Not applicable to this alternative

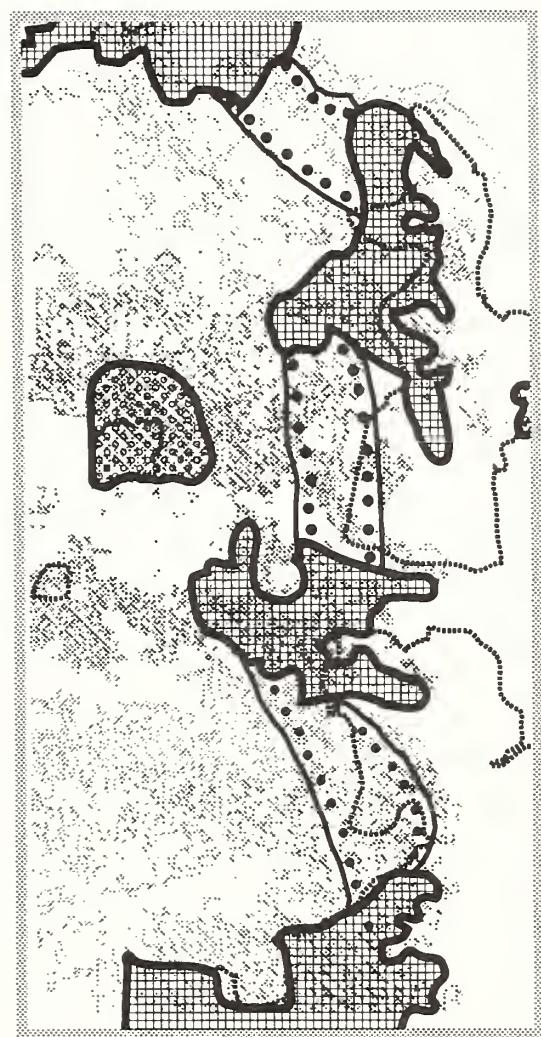
Figure S – 6 Alternative E

### Multi-Resource Strategy

This Alternative would apply "A Multi-Resource Strategy" lands in National Forests within the range of the northern spotted owl. This strategy was developed by the National Forest Products Association and American Forest Council.

Timber harvest would be very limited and other development restricted in Reserved and Deferred Multiple-Pair Areas (MPAs); some harvest could occur in Research MPAs. Connecting Habitat is managed for 30 to 50 percent spotted owl nesting, roosting, and foraging habitat.

Representation of designated areas managed primarily for spotted owl habitat in Alternative E, Multiple-Pair Areas (MPAs) plus Connecting Habitat.



### Legend

Designated areas managed primarily for spotted owl habitat



Northern spotted owl nesting, roosting, and foraging habitat



Reserved Lands (e.g., Wilderness and National Monuments)



Spotted Owl Habitat Area (SOHA)



Not applicable to this alternative

Habitat Conservation Area (HCA)



Not applicable to this alternative

Critical Habitat Unit (CHU)



Not applicable to this alternative

Reserved and Deferred Multiple Pair Areas



Research Multiple Pair Areas



Connecting Habitat



## *Summary*

This page left blank for notes

## Comparison of the Alternatives

---

This section of Chapter 2 compares the important environmental impacts of the alternatives on forest resources. The analysis and the sources of data are discussed in detail in Chapter 3&4, and in Appendix B, Analytical Models.

### Spotted Owl Viability

#### Criteria

Viability ratings were assessed for each of the five alternatives using seven criteria. The ratings definitions range from HIGH (H) to LOW (L). A HIGH rating denotes a high likelihood of viability of the subspecies; a MEDIUM rating denotes an uncertain likelihood of viability; and a LOW rating denotes a low likelihood of viability. In summary, the criteria address:

1. **Potential Change** - current and predicted amount of owl habitat and potential rate of change in habitat.
2. **Distribution** - how nesting, roosting, and foraging habitat is distributed throughout the range of the northern spotted owl.
3. **Habitat Capability** - current and future habitat capability, estimated as potential pairs of northern spotted owls.
4. **Dispersal Habitat** - habitat for spotted owl movement or dispersal.
5. **Spacing** - spacing between designated areas.
6. **Patch Size** - size and distribution of spotted owl habitat patches within designated areas.
7. **Clustering** - the number and size of areas large enough to support multiple pairs of spotted owls.

#### Viability Rating for the Alternatives

The alternatives were assigned a viability rating based on the criteria used to assess population viability. The viability ratings were established by a panel of spotted owl scientists and biologists. The overall rating for each alternative combined quantitative

## *Summary*

analyses with the panel's collective professional judgment and specific scientific knowledge of spotted owl population dynamics and habitat conditions.

The viability ratings are based on the assumptions that Forest Plans will be implemented as specified, and that other Federal land managers will manage forests in accordance with Section 7(a) of the Endangered Species Act. If these conditions change in the future, the effect on the viability of the northern spotted owl will be reevaluated.

The viability criteria evaluated how well each alternative provides for adequate numbers and distribution over space and time, to ensure viable populations of northern spotted owls well distributed throughout National Forests within the range of the owls. With respect to the viability of the northern spotted owl, short term refers to approximately the next 50 years; long term refers to a century or longer.

### **Summary of Viability Ratings:**

Alternative A - LOW likelihood of population viability  
Alternative B - HIGH likelihood of population viability  
Alternative C - HIGH likelihood of population viability  
Alternative D - HIGH likelihood of population viability  
Alternative E - LOW likelihood of population viability

The above viability ratings assume other Federal Agencies will manage their land with a level of owl protection similar to the ISC Strategy, through consultation with the U.S. Fish and Wildlife Service under Section 7(a) of the Endangered Species Act.

Participation by the Bureau of Land Management is necessary to provide for high population viability under Alternatives B, C, and D. Bureau of Land Management lands are particularly important to populations in the Oregon Coast Range and interchange of owls between the Klamath and Oregon Cascades Provinces. National Park lands are particularly important to viability of owls on the Olympic Peninsula.

### **Alternative A**

Alternative A would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would not ensure a well-distributed population.

**Numbers.** Under Alternative A, spotted owl population numbers would likely decline at significantly high rates even in the short term. Habitat capability at year 150 indicates population sizes may be too small to ensure viable populations of spotted owls; habitat capability at year 150 is expected to be 30 percent of current capability estimates. Alternative A has no provision for conserving relatively large clusters of pairs (20 or more pairs).

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative A would also cause a low likelihood of population persistence over time. At the scale of pair home ranges, habitat would be designated in small, discontinuous patches. Alternative A would also cause increases in fragmentation of habitat, which in turn would likely degrade habitat quality. Alternative A does not provide for movement or dispersal habitat. Other problems with ensuring short- and long-term distribution of spotted owl habitat under Alternative A include no specific provision for improving current distribution problems in areas of concern, and very limited provision for mitigating for catastrophic loss of habitat. All of these conditions would likely not provide for well distributed populations over time.

Alternative A was also rated as providing a low likelihood of persistence of spotted owl populations in a report by the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991). The Interagency Scientific Committee also stated that the strategy would result in significant risk to the long-term persistence of the subspecies (Thomas et al. 1990: 384).

### **Alternative B**

Alternative B would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure well distributed viable populations over the long term.

**Numbers.** Spotted owl habitat capability would be provided at substantially higher levels than under Alternative A. Over the long term, Alternative B would provide for an increasing habitat base. Habitat capability is expected to be 74 percent of current capability estimates.

Alternative B also provides for relatively large (20-pair) clusters of spotted owl pairs, and provides for designation of a substantial area of young forests to become nesting, roosting, and foraging spotted owl habitat over time for additional pairs. This would enhance the

## Summary

connectivity of Habitat Conservation Areas over the long term, as well as provide for additional sources of reproductive pairs.

**Distribution.** Movement and dispersal habitat is specifically designated under Alternative B. This is a major provision that substantially enhances the occupancy rates of spotted owls within Habitat Conservation Areas by allowing for recolonization among pair clusters.

Clusters of pairs are to be provided in large sizes generally adequate to withstand some catastrophic losses of habitat due to fire, wind, etc. These factors are critical to ensuring long-term persistence of spotted owl pairs within Habitat Conservation Areas and populations.

There are still short-term concerns for persistence of spotted owl populations in the Oregon Coast Range and Olympic Peninsula because these populations are small and at least partially isolated from other populations, and because habitats are highly fragmented. Alternative B addresses these areas of concern and provides for increased conservation of nesting, roosting, and foraging habitat therein.

The Interagency Scientific Committee (Thomas et al. 1990) concluded that full implementation of the ISC Strategy would provide for a high likelihood of population persistence over the next century throughout the current range of the northern spotted owl. Further, in their report the Scientific Panel on Late-Successional Forest Ecosystems also concluded that the ISC Strategy would provide for a high likelihood of persistence of the subspecies (Johnson et al. 1991).

On December 18, 1991, the U.S. Fish and Wildlife Service issued their biological opinion on the Draft Environmental Impact Statement and stated, “It is the biological opinion of the Service that adoption of the preferred alternative B, the Interagency Scientific Committee’s *A Conservation Strategy for the Northern Spotted Owl* (Conservation Strategy) [Thomas et al. 1990] is not likely to jeopardize the continued existence of the northern spotted owl.”

## Alternative C

Alternative C would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** Alternative C provides for an increasing habitat base over the long term. Habitat capability at year 150 is expected to be 92 percent of current capability estimates. Future habitat capability estimates for the Olympic Peninsula and Oregon Coast Range Physiographic Provinces are higher for Alternative C than for any of the other alternatives, except Alternative D.

Alternative C also provides for larger designated areas managed primarily for spotted owl habitat, and thus for larger clusters of pairs, than under Alternative A or B. This would provide for a higher persistence of pair clusters and a higher likelihood of reoccupancy of vacant habitats.

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative C would provide for more suitable habitat in larger and more contiguous blocks than under Alternative A or B. These conditions would result in a higher likelihood of maintaining well distributed populations over time.

Additionally, Alternative C specifically provides for movement and dispersal habitat among designated areas managed primarily for spotted owl habitat. Overall, Alternative C would likely result in well distributed populations over time.

#### **Alternative D**

Alternative D would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** Spotted owl population numbers provided under Alternative D are incrementally greater than those under Alternative B. Habitat capability at year 150 is expected to increase 40 percent over current capability estimates. Yet, over the long term, Alternative C would provide for a greater amount of young forests to grow into nesting, roosting, and foraging habitat conditions than under Alternative D.

**Distribution.** Alternative D would designate large contiguous habitat areas, and in addition, substantial amounts of nesting, roosting, and foraging habitat between designated areas. Alternative D also provides for specific conservation and restoration of habitat in areas of concern. The size of habitats designated under Alternative D also would be adequate to withstand some catastrophic losses of forests.

## Summary

For all these reasons, Alternative D provides for population viability incrementally better than does Alternative B. Overall, Alternative D fares better for viability than does Alternative C; however, in the Olympic Peninsula and Oregon Coast Range effects on viability are similar for the two alternatives.

### Alternative E

Alternative E would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would not ensure a well distributed viable population.

Alternative E does not provide for some conditions key to ensuring population persistence in well distributed patterns.

**Numbers.** Spotted owl population numbers provided under Alternative E are expected to decline in the short and the long term. Habitat capability at year 150 is expected to be 43 percent of current capability estimates.

Alternative E provides for fewer and smaller clusters of spotted owls than Alternative B, C, or D. Many clusters are smaller than the size described in the scientific literature as necessary for long-term persistence.

**Distribution.** Alternative E prescribes specific management for spotted owl habitat within the Owl Management Zone. This zone does not include all National Forests within the range of the northern spotted owl specifically the Olympic and the north portion of the Siuslaw National Forests. Thus, in the long term it is likely that the range of the owl would be significantly reduced. Alternative E does provide for dispersal habitat between designated areas, but only for the portion of the range of the northern spotted owl within the Owl Management Zone.

Under Alternative E, there is limited latitude for loss of habitat due to catastrophic events because of the narrowness of the band of designated areas managed primarily for spotted owl habitat in the Washington and Oregon Cascades.

For these reasons, especially the problems with limited distribution and small cluster sizes, Alternative E provides for a LOW likelihood of providing viability of northern spotted owl populations well distributed throughout the planning area over time.

## **Environmental Consequences to Forest Ecosystems**

Alternatives A, E, B, C, and D designate increasing amounts of designated areas managed primarily for spotted owl habitat, respectively. The designated areas affect various resources differently.

Listed below is a summary of resource effects which are described more completely in Chapter 3&4, and in the appendices in Volume 2. Although these effects are examined in this document for consideration in the selection of a preferred alternative, it is not possible within the scope of this analysis to meet the absolute needs of, or remove every negative effect on, each of the following resources.

**Old Growth.** Old-growth forests are valued for their ecological diversity, scientific values, wildlife habitat, and recreational and scenic qualities, as well as for their potential contribution toward meeting timber production goals. There is much debate over both the definition of old-growth forests and the estimates of how much exist. Forest Service inventories indicate approximately 5.41 million acres of old-growth forest exist on the 17 National Forests included in this analysis. The amount of old-growth forest remaining after 50 years would vary from 3.67 million acres to 4.51 million acres across the alternatives.

**Insects and Diseases.** The level of insects and diseases will generally increase in designated areas managed primarily for spotted owl habitat in the dryer parts of the spotted owl's range because of a shift toward less insect and disease resistant tree species, lack of tree stocking control, and/or a failure to remove infected trees. This will likely reduce stocking levels and reduce some desirable structural components of the stand such as large trees (which will turn into large snags) and increase the hazard for catastrophic fires. The impacts from insects and diseases will be much greater within the east side mixed-conifer forest ecosystems and in the absence of preventative measures, habitat will be degraded.

**Port-Orford-cedar.** This is a highly valued tree species with limited distribution in southwest Oregon and northwest California. Many Port-Orford-cedar stands are currently being killed by an introduced root disease. Maintenance of this species has become a major concern and an action plan for Port-Orford-cedar (USDA Forest Service, unpublished) is being implemented by the BLM and the National Forests in Oregon and northern California. Designation of areas managed primarily for spotted owl habitat could limit timely removal of infected trees before spores can

## Summary

spread. However, uninfected drainages could benefit from such designation.

**Pacific Yew.** This tree is the principle source for taxol, a promising anti-cancer agent, which makes it an important commercial tree species. There is concern over harvesting Pacific yew because it does not regenerate freely in many management regimes. Pacific yew is commonly found in old-growth stands. The increased areas managed primarily for spotted owl habitat in Alternatives A, E, B, C, and D, respectively, would provide more habitat for the species, but may reduce its availability for medicinal use.

**Threatened, Endangered, and Proposed Species.** The species of threatened, endangered and proposed plants and wildlife that may be affected by management of spotted owl habitat are generally favored by the alternatives that provide the greatest amount and distribution of designated areas managed primarily for spotted owl habitat. In general, the alternatives with the most designated area incur the least amount of risk to threatened, endangered and proposed species due to habitat modification and human-caused disturbances.

**Wildlife Species.** Those wildlife species that are closely associated with old-growth or late-successional forests also benefit more from alternatives designating more spotted owl habitat.

Wildlife species that use early-successional forests may currently have greater amounts of habitat created by clearcut harvest in the last several decades available to them than was historically available due to natural processes such as wildfire. The trend of increasing harvest-created early-successional forest habitat will reverse in areas designated primarily for spotted owl habitat. Species using early-successional forests and edge habitats may benefit more from alternatives that provide fewer and smaller designated areas managed primarily for spotted owl habitat.

**Watershed, Fisheries, and Soils.** These resources are generally protected in all alternatives by existing best management practices, standards and guidelines, and mitigation measures. High rainfall events and other factors point to some negative effects from timber harvests on these resources. In general, the alternatives with the most designated areas managed primarily for spotted owl habitat incur the least amount of risk on water quality, fisheries, and soils due to decreased sedimentation and more stable water temperatures.

**Fuels Management.** Fuels management activities are generally associated with vegetation management projects like timber sales, partly because much of this work is funded directly from timber sale receipts. If funding for fuels management in or around designated areas is not available from some other source, the risk of catastrophic fires is likely to increase.

**Mineral Resources.** These resources could be affected as some geothermal, oil, and/or gas development opportunities are foregone within designated areas managed primarily for spotted owl habitat. At the same time, mining of locatable minerals, which is permissible if the areas are not withdrawn from mineral entry, may necessitate tree removal and thus affect some habitat within the designated areas.

**Recreation.** The trends in recreational opportunities on the National Forests will be little affected by Alternative A or E. The trend towards greater acreage for road-based opportunities will progressively slow or reverse in Alternatives B, C, and D, and provide a more stable or slightly increasing land base for primitive and non-motorized recreation. Ski area development or expansion will be constrained in Alternatives C and D, and some will be constrained in Alternative B. The trend toward management for visual quality on the National Forests will slow or reverse with Alternatives B, C, and D, with progressively fewer viewsheds showing signs of roads and timber harvest.

**Cultural Resources.** Cultural resources will be less disturbed in alternatives that designate greater areas managed primarily for spotted owl habitat, but where features are naturally deteriorating, these resources will also be less likely discovered through pre-project surveys.

**American Indian Religious Sites.** American Indian religious sites incur the least amount of risk in alternatives with the most designated area managed primarily for spotted owl habitat.

**Transportation Systems.** There will be less road building under alternatives designating more areas for spotted owl habitat, with corresponding differences in effects on forest resources and activities. On portions of designated areas where roads already exist, some roads will be closed because of reduced need and funding.

## Timber Management on the National Forests

On National Forests in Washington, Oregon, and northern California within the range of the northern spotted owl there are approximately 12,298,000 acres of land considered technically suitable (potentially suitable) for timber production (Table S – 1). Under Alternatives A (SOHAs), B, C, D, and E designated areas managed primarily for owl habitat preclude timber production on 4 percent, 23 percent, 27 percent, 38 percent, and 8 percent of these lands, respectively. Final or Draft Land and Resource Management Plans designate an additional 22 percent, or 2,650,000 acres, of technically suitable lands to be managed for resource values such as stream protection, scenic corridors, etc. The remaining areas would be considered suitable for timber production.

**Table S – 1 Acres Suitable for Timber Production, by Alternative**

Acres technically suitable for timber production	Acres selected as suitable for timber production				
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
12,298,000	9,150,200	6,747,900	6,275,000	4,951,900	8,548,500
% of tech. suit:	74%	55%	51%	40%	70%

Partly because forest stands designated to be managed primarily for spotted owl habitat tend to be older, higher volume stands, there is not a linear relationship between the number of acres designated for spotted owl habitat, and reduction in Allowable Sale Quantity (ASQ). The effect of decreasing amounts of suitable timber acreage in Alternatives A, E, B, C, and D, respectively, is a substantial decrease in ASQ.

**Table S – 2 Average Annual Allowable Sale Quantity (ASQ)**  
Average annual allowable sale quantity and percent change from Alternative A. (million board feet)

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Washington	752	328 (-56%)	279 (-63%)	150 (-80%)	564 (-25%)
Oregon	1846	1214 (-34%)	982 (-47%)	470 (-75%)	1449 (-22%)
California	600	281 (-53%)	264 (-56%)	189 (-69%)	444 (-26%)
Total	3198	1823 (-43%)	1525 (-52%)	809 (-75%)	2457 (-23%)

Standards and guidelines preclude scheduled timber harvest within designated areas managed primarily for spotted owl habitat in all alternatives except Research MPAs in Alternative E. Research MPAs permit some harvesting for research purposes.

For Alternatives B, C, D, and E, forest lands between designated areas managed primarily for owl habitat are generally managed for dispersal habitat. Standards and guidelines for Alternatives B, C, and D require dispersal habitat to be managed to achieve or maintain at least 50 percent of the area having 40 percent canopy closure or greater in trees 11 inches or more d.b.h. This requirement accounts for 300 million board feet of the ASQ reduction in Alternatives B and C when compared with Alternative A. Alternative E has a similar dispersal habitat constraint but the effect is closer to 250 million board feet reduction when compared to Alternative A because the Alternative E constraint does not apply to all forest lands.

Under current Forest Plan land allocations, there are few opportunities to mitigate the reduction in ASQ through more intensive management. Forest Plans already schedule most economically viable and practical stand treatments that affect ASQ.

## **Economic and Community Consequences**

There are five primary criteria which can be used to provide a comparison of the economic and community effects of the alternatives. These five criteria are employment, income, revenues, payments to counties, and timber market effects.

### **Employment and Income**

National Forest timber harvests in Washington, Oregon, and Northern California are an important source of employment and income. Over the past 5 years, timber harvests from the 17 National Forests included in this analysis have created an average annual employment level of 71,100 jobs with an associated income of \$3.2 billion. Alternative A would provide the highest future employment and income. This alternative would generate employment of 48,000 jobs annually with an income of \$2.2 billion. Alternative B would reduce employment from Alternative A by 20,700 jobs per year (43 percent) and related income by \$486 million (46 percent). Alternative C would have further reductions in employment and income, lowering employment and income 52 percent. The lowest employment and income would occur under Alternative D. It would generate 12,400 jobs and an income of \$543.4 million. This is a reduction from Alternative A of 74

## *Summary*

percent. Alternative E would reduce employment from Alternative A by 10,900 jobs (23 percent) and related income by \$427.9 million (23 percent).

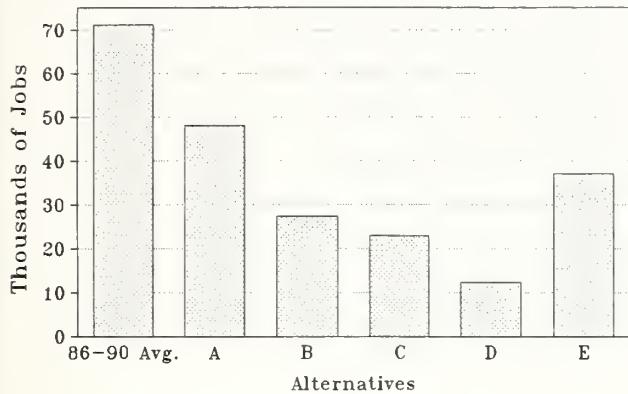
Timber harvests from National Forests generate revenues which are returned to the Federal Treasury. Alternative A would provide the highest revenue levels in the future. It would generate revenues of \$940 million annually by 1995. Alternative B would reduce these revenues by \$275 million or 29 percent. Alternative C would reduce revenue levels by 46 percent annually by 1995. Alternative D would return the least amount of money to the Federal Treasury, generating revenues of \$351 million from timber sales. This is 63 percent less than Alternative A. Alternative E would reduce revenues by \$175 million (19 percent) from Alternative A.

### **Payments to Counties**

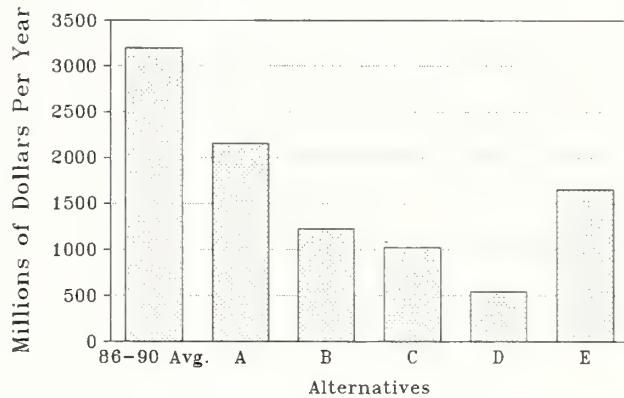
Under current law, 25 percent of the revenues collected by each National Forest are returned to the local counties within that National Forest. These funds can be used for roads or schools, and represent an important source of income for many counties. Alternative A would provide approximately \$235 million in annual payments to counties. Alternative D would provide the lowest returns, amounting to \$88 million. Alternatives E, B and C would provide \$191 million, \$166 million, and \$127 million respectively in payments to counties.

The changes in National Forest timber harvest associated with the alternatives would affect national and regional timber markets. As Alternatives E, B, C, and D progressively reduce National Forest timber harvests, prices of wood products would increase. These higher prices would stimulate increased production from private lands and other regions in the United States. The higher prices would also lead to an increase in imports of wood products from other countries, primarily Canada.

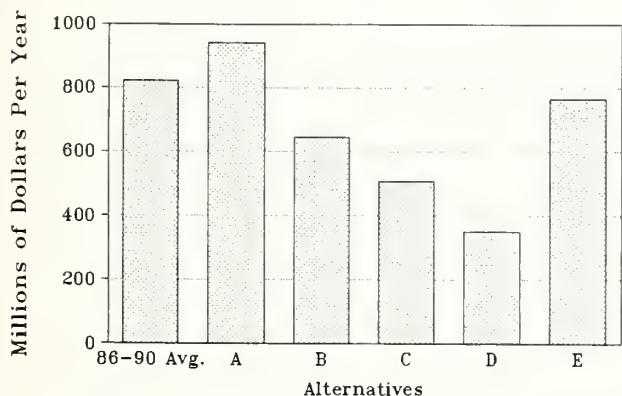
**Figure S - 7**  
**Historic and Projected Employment**  
 National Forest employment effects including  
 5 year average and projected for 1995  
 by alternative



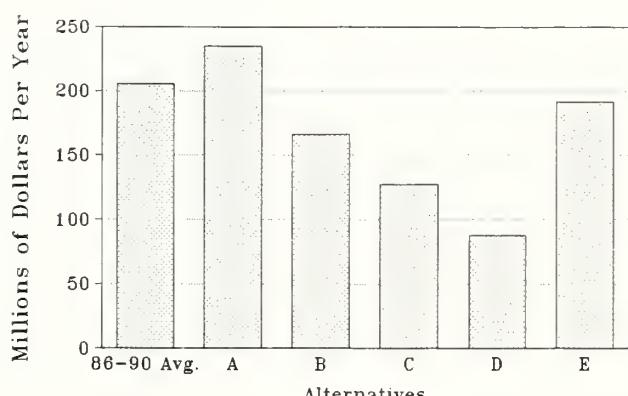
**Figure S - 8**  
**Historic and Projected Income**  
 National Forest income effects including  
 5 year average and projected for 1995,  
 by alternative



**Figure S - 9**  
**Historic and Projected Revenues**  
 National Forest revenues effects including  
 5 year average and projected for 1995,  
 by alternative



**Figure S - 10**  
**Historic and Projected Payments to Counties**  
 National Forest payments to counties effects  
 including 5 year average and projected for  
 1995, by alternative



### **Social and Community Consequences**

Changes in the management of the National Forests affect people and the families, groups, and communities to which they belong. The social, community, and cultural changes resulting from the alternatives will be felt almost exclusively in western and central Washington and Oregon, and the northwest quadrant of California. The social effects are primarily those which flow directly and indirectly from economic changes in wood products and forestry employment. These effects will be disproportionately intense in rural and timber-dependent areas.

Effects on individuals from job loss include: depression, spouse and child abuse, alcohol and drug abuse, social conflict and stress-induced illness. With this combination of factors, many people are likely to suffer both a loss of self-esteem and a reduced ability to make sound decisions about retraining, moving, or new jobs.

Reductions in payments to counties (see previous discussion in this section) will occur at a time when county governments are pressed to provide help for citizens stressed by downturns in employment. Cutbacks in community services tend to erode essential community institutions and the spirit of a community. These services are vital for helping communities make a transition from heavy reliance on timber to a more diversified economy.

The social effects of the alternatives stem fairly directly from changes in the timber harvest levels of the alternatives.

With Alternative A, timber-dependent communities and local governments will face the social effects of future average timber harvest levels as low as those experienced only twice in the last 10 years. The social effects of Alternatives B, C, and D will focus around the implications of community-wide job loss, and the related effects of changes in the management of the National Forests. While it is not possible to quantify the degree of those community effects, they will intensify to an extent comparable to the reduction in timber harvest. Where Alternative B represents a 43 percent reduction from the levels of Alternative A, Alternative C is a 52 percent reduction, and Alternative D is a 75 percent reduction. As timber harvest declines, the social effects will be similar but even more intense and debilitating to timber-dependent communities.

The loss of business vitality in rural towns from reductions in timber and other forest development activities compounds the difficulty in providing services, skilled work force, and the quality of life and appearance that will attract new industries and recreational visitors.

The social effects of Alternative E in the aggregate are between those of Alternative A and B; Alternative E represents a 23 percent reduction from the levels of Alternative A. The impacts will be very noticeable in some communities, and not experienced in others.

Timber-dependent communities and the wood products industry have experienced many changes. Changes resulting from business cycles, automation, and planned reductions in timber harvest have been met and adapted to with some success. The changes that would occur in implementing Alternative B, C, or D are different from the changes that these communities experienced in the past or foresaw for the near future.

There is a difference in the permanence of the changes. A market downturn in 1982 forced reductions in timber harvest in National Forests in Washington, Oregon, and California to levels roughly similar to those of Alternative C. Those changes were seen as, and were, temporary. Most communities, individuals, and families were able to cope successfully. The changes in timber harvest from Alternative B, C, or D will last longer than any firm or worker's ability to "wait it out". The changes in timber harvest under Alternative E would have less impact than under Alternative B, but would still result in a downturn from future harvest levels under Alternative A.

There is a difference in the amount of change. Alternative D would force harvest levels lower than experienced in Washington, Oregon, and California in the last two decades.

There is a difference in the source of the change. People in the wood products industry have a strong commitment to the workings of the marketplace—the source of previous changes. Changes stemming from these alternatives are a result of the interpretation of laws and regulations, and the findings of scientists.

There is a difference in the attitude of the rest of society. There is a perception that there is little support for the plight of people in the industry and in timber-dependent communities.

For these reasons, changes to timber-dependent communities and their people from the implementation of Alternative B, C, or D are different from previous changes they have experienced and weathered. These communities—loggers, mill owners and workers, and small businesses—and their families will experience significant, long-lasting, impacts that will be difficult to overcome.

## *Summary*

### **To Obtain a Complete Environmental Impact Statement and/or a Record of Decision**

This was a concise summary of the comprehensive analysis contained in a two volume Final Environmental Impact Statement. For more information about the subjects summarized, a person should obtain a copy of the complete two volume final environmental impact statement.

This summarizes the Final Environmental Impact Statement but it does not contain a final decision. The final decision will be contained in the Record of Decision to be signed by the Secretary of Agriculture not sooner than March 2, 1992.

For a copy of the two volume Final Environmental Impact Statement and/or the Record of Decision when it is available in March write to:

Jerald N. Hutchins  
Spotted Owl EIS Team Leader  
USDA-Forest Service  
P.O. Box 3623  
Portland, Oregon 97208

# 1

---

## Chapter 1

### Purpose and Need

# **Changes Between Draft and Final**

## **Chapter 1**

There was one substantive change in Chapter 1 between the release of the Draft and the Final Environmental Impact Statements.

- The section describing the Forest Service appeal of the decision in *SAS v. Evans* was deleted because the Ninth Circuit Court upheld the District Court.

# Chapter 1

## Purpose and Need

### Introduction

This chapter briefly specifies the underlying purpose and need to which the Forest Service is responding in proposing the alternatives including the proposed action.

### Purpose and Need

The Forest Service has a need to manage habitat for the northern spotted owl (*Strix occidentalis caurina*) on National Forests within the requirements of the National Forest Management Act (NFMA) and its implementing regulations as interpreted in *Seattle Audubon Society, et al. v. Evans, et al.*, No. 89-160WD (*SAS v. Evans*).

The underlying purposes are:

1. to satisfy the court order “to submit to the court and have in effect by March 5, 1992 revised standards and guidelines to ensure the northern spotted owl’s viability, together with an environmental impact statement, as required by NFMA and its implementing regulations.” (*SAS v. Evans*), and
2. to amend the Regional Guide and the Forest Land and Resource Management Plans for the Pacific Northwest Region, and amend the Regional Guide for the Pacific Southwest Region, to provide management direction to maintain viable populations of the northern spotted owl in National Forests within the range of the northern spotted owl.

### Alternatives Including the Proposed Action

The alternatives respond to this underlying need and its purposes. The alternatives include the alternative of no-action which is Alternative A.

*Purpose and need*

**The Proposed Action**

The proposed action is to manage National Forests within the range of the northern spotted owl in accordance with the Interagency Scientific Committee's report "A Conservation Strategy for The Northern Spotted Owl" (Thomas et al. 1990). This proposed action would apply only to lands administered by the Forest Service.

With this proposed action and alternatives, the Forest Service is not attempting to resolve the entire spotted owl issue or resolve the old-growth controversy. The alternatives presented here are alternative management directions to maintain viable populations of the northern spotted owl within National Forests; this environmental impact statement discloses the effects of those alternatives on other forest resources and the human environment.

**Related Activities**

The northern spotted owl is the subject of actions by several other agencies. These are reviewed in Appendix E, Related Activities.

# 2

---

## Chapter 2

### The Alternatives

## **Changes Between Draft and Final**

### **Chapter 2**

These were the principal changes to Chapter 2 between the release of the Draft and the Final Environmental Impact Statements.

- In response to public comment, the “Multi-Resource Strategy” is evaluated as an alternative considered in detail—Alternative E.
- Alternative C is based on the U.S. Fish and Wildlife Service’s final rule on Critical Habitat of January 1992 rather than their proposed rule of May 1991.
- The folding display maps for the Alternatives have been corrected to portray the actual Habitat Conservation Area (HCA) boundaries established by the Interagency Scientific Committee (ISC).
- The section comparing alternatives incorporates the new information presented in Chapter 3&4.
- Information on the process of implementing and interpreting the selected alternative has been added. See Appendix J, Monitoring Plan.

# Chapter 2

## The Alternatives

### Introduction

Chapter 2 presents the alternatives including the proposed action. Following a discussion of the issues, five alternatives are presented. Each alternative is a plan for managing habitat for the northern spotted owl on the National Forests.

Each alternative consists of different designated areas managed primarily for spotted owl habitat, standards and guidelines, and adjustment and implementation processes. Following these alternatives is a comparison of their major points and differences.

### The Issues

For over a decade there has been growing controversy over managing the National Forests for the northern spotted owl, and the problem is more complex than the conflict of “owls vs. jobs.” The interdisciplinary team’s review of past documents, public comments, court cases, media reports and features, and the concerns of Forest Service managers led to this description of the principal issues. These issues serve to focus the comparison of the alternatives.

The northern spotted owl is listed under the Endangered Species Act of 1973 as threatened with extinction as a subspecies by the U.S. Fish and Wildlife Service. The long-term viability of the spotted owl depends on adequate, well-distributed habitat for all of its life functions.

The set of factors affecting long-term viability of the northern spotted owl are complex and not precisely known. While most people want to see the spotted owl survive, there is disagreement over what populations should be provided for and the forest management that will ensure long-term survival.

## The Alternatives

A forest ecological system is complex and varied. Managing to preserve and enhance spotted owl habitat has major implications for the overall structure and function of the entire forest, the water quality in streams and rivers, the appearance of the forest, and the age, quality, and composition of its plant and animal communities.

Species which need young forests and species which need old forests are affected by changes in the age, composition, and distribution of forest areas. Management to provide the diversity of the forest's structure and function is itself an issue. The spotted owl has been selected as an indicator for other species and many people see it as a surrogate for old-growth stands and other old-growth related species. It has become a stand-in in the debate over how the National Forests should be managed. The management of habitat for the spotted owl will affect many other wildlife species and the old-growth forest ecological systems themselves.

Timber management has been a major part of the Forest Service's role of actively managing the National Forests for a variety of sustainable benefits for the Nation. The timber management program on the National Forests within the range of the spotted owl has focused on harvesting older forest areas for timber and replacing them with faster growing young stands. Since older forest areas are central to the spotted owl's habitat, this part of the timber management program impacts spotted owl habitat and the viability of this subspecies.

Managing the National Forests to provide habitat for a viable population of northern spotted owls may result in a change in the extent and rate of the harvest of older forest areas, as well as major changes in how other forest areas are managed. The design, implementation, and effects of those changes are controversial.

The logs and other wood from the Forest Service's timber management program are crucial raw material for the wood products industry and, after milling, serve the needs of a variety of consumers. The wood products industry's principal employment is located in small cities and towns, and in rural areas. Additionally, a quarter of the receipts from timber sales go to county governments for roads and schools.

Reductions in the amount of timber sold for harvest have direct effects on the employment and economic health of the forestry and wood products industries. These immediately affect the economic vitality of the communities dependent on them, and the well being of workers and families. The viability of some of these communities and their institutions will be threatened.

There are other human uses of the National Forests that will be enhanced, maintained or curtailed in managing habitat for the spotted owl. Road construction and use, recreation, mining, and other land uses might all be affected. There may be alternate paths for people and

communities to take to adjust to changes. The effectiveness of those paths, and the human costs and benefits of making those changes, is open to question.

## **Consultation**

Consultation under Section 7(a) of the Endangered Species Act with the U.S. Fish and Wildlife Service was conducted for the preferred alternative. The Service's Biological Opinion on Alternative B of "no jeopardy" was received on December 18, 1991, and appears here as Appendix M.

## **Critical Habitat**

In January 1992 the U.S. Fish and Wildlife Service determined the lands that are Critical Habitat for the northern spotted owl. (These lands are presented as Critical Habitat Units on the map for Alternative C in this environmental impact statement.)

Regardless of which alternative is selected in the Record of Decision, the Forest Service will prevent the adverse destruction or modification of Critical Habitat (36 CFR 219.19(a)(7)). The appropriateness of a proposed action in Critical Habitat will be determined through consultation with the U.S. Fish and Wildlife Service according to Section 7(a) of the Endangered Species Act

## **Monitoring**

Monitoring is an essential component of managing for the northern spotted owl. All the alternatives would, as they are implemented, monitor three crucial aspects of the management plan. This monitoring will provide information to determine if the standards and guidelines are implemented consistently, to verify whether they are having the predicted effect, and to determine if key underlying assumptions are sound. The Monitoring Plan is presented in Appendix J of this environmental impact statement.

## **Mitigation and Resource Management Direction**

"Mitigation" refers to measures that avoid, minimize, compensate for, or rectify adverse environmental effects. In this environmental impact statement, Alternative A would implement the Regional Guides, Forest Plans, and other resource management direction. All of this existing management direction has environmental and resource mitigation as an integral part. The other four Alternatives (B, C, D, and E) retain all of the mitigation measures and standards and guidelines of the existing land and resource management direction except for that directly superseded by the designated areas and standards and guidelines for these alternatives.

Direction to manage and protect the environment and resources of the National Forests is in place; these alternatives add to that direction. This environmental impact statement adds no additional direction for resources other than for the management of spotted owl habitat.

## *The Alternatives*

Measures to mitigate potential adverse environmental impacts on other resources are in place; this environmental impact statement proposes no additional mitigation for other resources apart from the direction for managing habitat for the northern spotted owl.

### **The Alternatives**

Each alternative is a plan for managing habitat for the northern spotted owl on the National Forests. Each consists of different designated areas managed primarily for spotted owl habitat, standards and guidelines, and adjustment and implementation processes.

### **Designated Areas**

A central element of each alternative is the designated areas managed primarily for spotted owl habitat. The management of these areas varies by alternative. The designated areas managed primarily for spotted owl habitat are:

- Alternative A: Spotted Owl Habitat Areas (SOHAs)
- Alternative B: Habitat Conservation Areas (HCAs)
- Alternative C: Habitat Conservation Areas (HCAs) Plus at Units (CHUs)
- Alternative D: Habitat Conservation Areas (HCAs) Plus All Nesting, Roosting, and Foraging Habitat
- Alternative E: Reserved, Deferred, and Research Multiple-Pair Areas (MPAs)

### **Dispersal Habitat**

Alternatives B, C, D and E also incorporate management direction for lands in National Forests outside the designated areas managed primarily for spotted owl habitat. These lands are known as the “Forest Matrix” in Alternatives B, C, and D; they are known as “Connecting Habitat” and “Owl Management Zone” in Alternative E. They provide for dispersal habitat between designated areas and for other incidental habitat needs.

## Alternative A (No-Action) Spotted Owl Habitat Areas (SOHAs)

### Introduction

Alternative A would manage the National Forests by using the established networks of 1000 to 3000 acre Spotted Owl Habitat Areas (SOHAs) as prescribed in the Records of Decision for the two Regional Guides. Oregon and Washington National Forests use the Pacific Northwest Regional Guide as amended in 1988. California National Forests use the Pacific Southwest Regional Guide dated 1984.

The “no-action” alternative is one which presents no change from the management direction that was in place before the Department of Agriculture announced on September 29, 1990, (55 Federal Register 40412, October 3, 1990) that the Forest Service would manage not inconsistent with the Interagency Scientific Committee’s Conservation Strategy (Thomas et al. 1990). The District Court found that the September 29th decision did not constitute compliance with the procedural requirements of the National Forest Management Act (*SAS v. Evans*, March 7, 1991 slip op. at p. 15).

#### Designated Areas Managed Primarily for Owl Habitat:

Spotted Owl  
Habitat Areas (SOHAs)

#### Lands Outside Designated Areas Managed Primarily for Owl Habitat:

No Specific Management  
for Northern Spotted Habitat

## **Standards and Guidelines**

### **Excerpt from Standards and Guidelines for Oregon and Washington**

**Oregon and Washington.** The management standards and guidelines for the Pacific Northwest Region are those established by the Record of Decision signed December 8, 1988. It amends the 1984 Regional Guide and is based on the Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide. The Forest Plans incorporated this regional direction and provide specific management direction for each National Forest.

The following pages contain the current standards and guidelines for the National Forests in Oregon and Washington as excerpted from Amendment Number 1 to the Regional Guide for the Pacific Northwest Region (Region 6).

The current standards and guidelines for California National Forests follow this excerpt.

Excerpt from Regional Guide for the Pacific Northwest Region

#### **Section 1: Standards and Guidelines**

##### **Standard and Guideline 1. Amount of suitable habitat in designated habitat areas.**

The intent of this standard and guideline is to insure that breeding pairs in areas designated for spotted owls have sufficient habitat within their home ranges to meet overall life needs for survival and successful reproduction.

The amounts of suitable spotted owl habitat at each designated habitat area will vary by physiographic province. The acreages should occur in at least one 300 acre stand of habitat that includes the nest site. Other habitats within 1.5 miles (Oregon) or 2.1 miles (Washington) of the nest site should be as contiguous as possible. The following amounts of suitable spotted owl habitat are to be designated per site:

Excerpt from Regional Guide for the Pacific Northwest Region (continued)

R-6

A

Amounts of Suitable Habitat To Be Designated			
Physiographic Province	National Forest	Amount of Habitat	Distance from Nest or Central Point
Olympic Peninsula	Olympic	3,000	2.1 miles
Washington Cascades	Mt. Baker-Snoq.	2,200	2.1 miles
	Okanogan	2,200	2.1 miles
	Wenatchee	2,200	2.1 miles
	Gifford Pinchot	2,200	2.1 miles
Oregon Coast Range	Siuslaw	2,000	1.5 miles
Oregon Cascades	Mt. Hood	1,500	1.5 miles
	Deschutes	1,500	1.5 miles
	Willamette	1,500	1.5 miles
	Umpqua	1,500	1.5 miles
	Rogue River	1,500	1.5 miles
	except Applegate District and west half of Ashland District		
Klamath	Winema	1,500	1.5 miles
	Siskiyou	1,000	1.5 miles
	Rogue River		1.5 miles
	Applegate District and west half of Ashland District		

Habitat areas may vary from the acreage objective if approved by the Regional Forester.

A habitat area may be larger than the acreage objective for suitable habitat if it meets at least one of the following [three] criteria:

1. The area contains more than one breeding pair of spotted owls, and it has been demonstrated that the reproductive rate, on average over time, has exceeded that necessary to replace the breeding adults.
2. The area is a key link in the network. A key link is defined as a spotted owl habitat area, which if not designated would result in a separation of the network contrary to spacing guidelines. Key links should be larger than the spotted owl habitat area acreage objective, especially where the local landscape contains little spotted owl habitat in lands unsuitable for timber production or in reserved lands, and where the general forest landscape is heavily fragmented.
3. On the Olympic National Forest where the designated habitat areas shall average 3000 acres individual areas may be larger to compensate for those where less than the prescribed acreage is available.

## *The Alternatives*

Excerpt from Regional Guide for the Pacific Northwest Region (continued)

Designated spotted owl habitat areas may contain less than the acreage objective for habitat where:

1. Breeding success within the previous two years has been documented and the amount and quality of spotted owl habitat has not declined significantly within the pair's home range during the previous two years.
2. The habitat area is necessary to meet spacing requirements and less than the suitable habitat acreage objective exists.
3. In addition, if acreage of suitable habitat is less than 1000 acres and meets one of the above criteria, potential habitat that will bring the total existing and potential habitat to 1000 acres shall be added.

Standard and Guideline 2. Spacing of designated habitat areas.

The intent of this standard and guideline is to insure that reproductive individuals are well-distributed so they can interact with others in the planning area (the regional population). The ability to interact provides for recolonization of unoccupied habitats, interchange of genetic resources, and resilience of populations to normal fluctuations in births and deaths.

Distances between habitat areas within clusters of three or more spotted owl habitat areas shall be not more than 1.5 miles measured edge to edge.

Distances between clusters of three or more spotted owl habitat areas or between habitats in land unsuitable for timber production that can support at least three pairs, shall be not more than 12 miles measured edge to edge except on the Olympic National Forest where they shall be not more than 8 miles.

Distances between all other habitat areas (cluster, single, or habitat area within land unsuitable for timber production that could support at least one pair) shall be not more than six miles measured edge to edge except on the Olympic National Forest where they shall be not more than 2 miles.

Distances between spotted owl habitat areas may be extended 20 percent (that is, up to 7.2 miles for singles and 14.4 miles for clusters, or 2.4 miles and 9.6 miles respectively on the Olympic National Forest). This variation applies only where needed to locate a habitat area at a site with higher level of spotted owl occupancy (i.e., contains pair, rather than single bird) than would be otherwise available.

Each designated habitat area should link to at least three other areas within the spacing standards. These three other areas can be other designated spotted owl habitat areas, or suitable spotted owl habitat in lands unsuitable for timber production. A cluster is not considered to be three distinct areas for the purpose of this positioning.

## Excerpt from Regional Guide for the Pacific Northwest Region (continued)

Spacing standards apply across boundaries of adjacent National Forests. National Forests adjacent to other ownerships having suitable spotted owl habitat that will be maintained over time should provide habitats to help ensure distribution across ownership boundaries, and, as far as practicable, coordinate their efforts to identify and designate habitat areas. In this regard, other ownerships include, but are not restricted to, USDI Bureau of Land Management and USDI National Park Service.

Standard and Guideline 3. Threatened and endangered species.

No spotted owl management activity shall adversely affect Federally listed threatened or endangered species or their habitats.

Standard and Guideline 4. Identification of suitable habitat.

The intent of this standard and guideline is to provide consistency and accuracy in identifying forest stand conditions that constitute suitable habitat for spotted owls. Its principal application will be in inventory, mapping, and monitoring to assure that the right kinds of habitat are being designated or counted as appropriate.

Vegetation types: Vegetation types in which spotted owl habitat occurs are:

Spruce/Cedar/Hemlock Forest  
Cedar/Hemlock/Douglas-fir Forest  
Mixed Conifer Forest  
California Mixed Evergreen Forest  
Silver fir/Douglas-fir Forest  
Red fir Forest  
Ponderosa Shrub Forest with White fir/Grand fir  
Fir/Hemlock Forest  
Grand fir/Douglas-fir Forest  
Douglas-fir Forest

Stand structure. The following structural characteristics identify forest stands suitable for spotted owls. These conditions occur at different ages for each vegetation type and location, but in general they occur in stands considered to be mature and old growth.

- a. Relatively large diameter of dominate trees in the stand.
- b. Multilayered canopy of trees with a moderate to high canopy closure in overstory, midstory, and understory layers.
- c. Large, tall trees with cavities, broken tops, mistletoe, or platforms of branches capable of holding accumulated organic matter suitable for nesting.
- d. Dead standing trees and fallen decayed trees to support abundant populations of prey species, especially northern flying squirrel and woodrat.

## *The Alternatives*

### Excerpt from Regional Guide for the Pacific Northwest Region (continued)

- e. Stands with the above conditions and larger than 60 acres in area.

National Forests will specify the inventory and mapping criteria used to identify suitable spotted owl habitat in Forest planning, subject to approval by the Regional Forester.

Suitable habitat (vegetation types and structural or developmental stages) shall be identified in Forest Plans for inventory, mapping, and monitoring purposes in accordance with the general description above.

**Standard and Guideline 5. Options for managing designated spotted owl habitat areas.**

The intent of this standard and guideline is to provide consistency and efficiency in planning the management of forest stands within designated spotted owl habitat areas.

Spotted owl habitat can be provided by even-aged or uneven-aged silviculture, or no scheduled harvest. Determination of the prescription selected will occur in the Forest Plans. Each National Forest will determine how spotted owl habitat is maintained through time.

**Standard and Guideline 6. Criteria for locating designated habitat areas.**

The intent of this standard and guideline is to designate spotted owl habitat areas without unnecessary restrictions of other uses of the forest, to the extent possible while meeting the management requirement for spotted owl population viability. This standard and guideline shall be used on all spotted owl Forests in the Pacific Northwest Region.

1. Map spotted owl habitat in the following land use designations in each National Forest's Land and Resource Management Plan: lands withdrawn by Chief's authority or higher, other lands unsuitable for timber production, lands suitable for timber production with reduced yields and lands suitable for timber production with full yields.
2. Map the known locations of spotted owls on each forest, and show locations of breeding pairs, pairs with verified non-breeding status or breeding status unknown, and other spotted owl sightings.
3. Identify areas in land unsuitable for timber production that have at least the specified acres of habitat within 1.5 miles of a central point in Oregon, and 2.1 miles from a central point in Washington.
4. Assess the distribution of habitat relative to spacing standards to determine if additional spotted owl habitat areas need to be designated. If designation is necessary, use mapped owl locations at the priorities for selecting spotted owl habitat areas in lands suitable for timber production.

Excerpt from Regional Guide for the Pacific Northwest Region (continued)

5. Designate spotted owl habitat areas on lands suitable for timber production if needed to meet the spacing standard.
  - a. If a verified breeding pair is located closer than six miles from the edge of lands unsuitable for timber production, or closer than two miles on the Olympic National Forest, then that area can be designated if there are no verified breeding pairs within the adjacent lands unsuitable for timber production.
  - b. The preference is to provide spotted owl habitat areas in a cluster arrangement.
  - c. Use reduced yield lands before full yield lands where compatible with other criteria.
  - d. Use the following priorities in designating spotted owl habitat areas on lands suitable for timber production (listed in decreasing order of priority):
    1. Verified occupancy by breeding pairs within the last 5 years. If verification is not based on data from the current year, the site should meet or approximately meet Regional standards for habitat amounts and characteristics, or the habitat amounts and characteristics must have remained stable since the year of verification.
    2. Verified occupancy by breeding pairs more than 5 years ago. If verification is not based on data from the current year, the site should meet Regional standards for habitat amounts and characteristics, or the habitat amounts and characteristics must have remained stable since the year of verification.
    3. Verified occupancy by pairs; verified non-breeding, or breeding status or success unknown. If verification is not based on data from the current year, the site should meet or approximately meet Regional standards for habitat amounts and characteristics, or the habitat amounts and characteristics must have remained stable since the year of verification.
    4. Presence of spotted owls; pair status unknown.
    5. Areas with an appropriate amount of suitable owl habitat, within the radius prescribed, where the presence or absence of owls is unknown. An appropriate amount of habitat is that specified in Standard and Guideline 1. Amount of suitable habitat in designated areas.

## Excerpt from Standards and Guidelines for California

**California.** The management standards and guidelines for the Pacific Southwest Region are those established by the Record of Decision signed September 27, 1984, for the Pacific Southwest Regional Guide, based on its Final Environmental Impact Statement. Because Forest Plans for northern California National Forests are still in the draft stage, the

## *The Alternatives*

Regional Guide currently sets the management direction for spotted owl habitat. When Forest Plans are completed, they will provide specific management direction for each National Forest.

The following pages contain the current standards and guidelines for the National Forests in California (Region 5) as excerpted from Appendix H of the Final Environmental Impact Statement for the Pacific Southwest Regional Guide dated August 1984.

Excerpt from the Final Environment Impact Statement for the Pacific Southwest Regional Guide

### APPENDIX H REGIONAL SPOTTED OWL GUIDELINES

#### 1. Principles and Intent

- a. The primary goal is to maintain sufficient suitable habitat for spotted owls, such that the continued existence of an adequate number and distribution of reproductive pairs is ensured throughout the existing range.
- b. For a given alternative, appropriate management prescriptions for spotted owl territories will be selected in terms of economic efficiency, while meeting the overall multiple-use objectives of the alternative.

#### 2. Overall Direction

- a. Forests will determine the number of spotted owl pairs needed to maintain a viable population level. The number of pairs will be approved by the Regional Office Fish and Wildlife Staff.
- b. Specific numbers of owls, habitat requirements, locations, and management prescriptions must be verified and monitored during plan implementation.
- c. The spotted owl trade-off analysis and direction for habitat and species management must be documented in the EIS and Forest Plan. However, it is not expected that spotted owl territories will be treated as separate and unique management areas in the Forest Plan.
- d. Presently in the analysis, spotted owl territories are used primarily as proxies to estimate the probable effects of management on PNV and other outputs, rather than explicit dedicated geographic locations. More research or studies may be needed to more specifically identify habitat locations and needs. If this condition exists, it should be clearly stated in the EIS.

Excerpt from the Final Environment Impact Statement for the Pacific Southwest Regional Guide (continued)

3. Direction for Northern Species of Spotted Owls: Klamath, Lassen, Mendocino, Six Rivers, and Shasta-Trinity National Forests

a. Habitat is composed of mature timbered stands having multilayered conditions, a canopy closure of 70% or greater, and obvious decadence. This habitat will be considered suitable habitat for the nesting, roosting, and feeding requirements of the spotted owl.

- (1) Brush-shrub layers are not to be included in the canopy closure determination.
- (2) The overstory should be primarily composed of trees 21" dbh or greater and should normally comprise at least 40% of the canopy closure.
- (3) The understory components should be composed of those species which presently occur on the site.
- (4) Decadence should be represented by broken-topped or defective trees and by standing and down dead material. The amount of decadence will be determined by each Forest.
- (5) Within the designated spotted owl habitat, the minimum snag requirement will be met. (This snag requirement is a part of the overall snag requirement for viable populations of other wildlife species.)

b. A spotted owl core area meets the habitat conditions defined in 3a and is 300 or more contiguous acres within which a known or potential nest site in the network is located.

- (1) Vegetation in each core area will be allowed to cycle naturally until a new core replacement area is established.
- (2) Where the core area does not currently contain 300 acres of the defined suitable habitat, but the potential exists for that habitat to occur within the core area, manage the deficient, potential acres to meet the defined habitat conditions.
- (3) Where the core area does not currently contain 300 acres of the defined habitat and no potential exists to create that habitat within the core area, a case by case analysis must be made to determine proper identification and management of the core area.

c. A spotted owl territory (home range) is the entire (usually undefined) area utilized by a breeding pair of owls throughout the year.

- (1) Within each territory of the spotted owl network, Forests will provide for 1,000 acres of suitable habitat (as defined in 3a) to be present in every time period of the planning horizon.

R-5  
—  
A

## The Alternatives

Excerpt from the Final Environment Impact Statement for the Pacific Southwest Regional Guide (continued)

- (a) The availability of 1,000 acres of suitable habitat beyond the planning horizon must also be ensured.
- (b) The 1,000 acres will include the contiguous 300-acre designated nesting core and an additional 700 acres which must include at least one 300-acre contiguous unit to serve as an alternate for the existing core; the remaining 400 acres may occur in 3 or less parcels, none of which is to be less than 60 acres in size.
- (2) The area within which Forests are to manage for the 1,000 acres of suitable habitat is to be no more than 1.5 miles from the center of the existing core area. (Generally, this 1.5 mile limit results in a maximum size of 4,500 acres.)
  - (a) Within the area, if 1,000 acres of suitable habitat do not currently exist but the potential exists for that habitat to occur within the 1.5 mile limit, manage the deficient potential acres to meet the defined habitat conditions.
  - (b) Within the area, if 1,000 acres of suitable habitat do not currently exist and there is no potential to create that habitat within the 1.5 mile limit, a case by case analysis must be made to delineate and determine proper management of the territory.
- d. For the required number of spotted owl pairs, Forests will identify habitat and develop a population network using the following guidelines:
  - (1) Identify all lands within the Forest boundary where suitable spotted owl habitat occurs (presently occupied range).
    - (a) Delineate all potential habitat using an approved wildlife habitat relationships model or other definitive habitat requirements.
    - (b) Plot all identified and/or suspected locations of territories on a base map.
  - (2) The network is the distribution of territories throughout the known range of the species that allows for continued dispersion and random interchange between members of the population.
    - (a) The network must provide coverage over all of the current range of the spotted owl on National Forest lands. Densities within the perimeter of the range might be reduced, but the perimeter will be maintained.
    - (b) The network consists of groups of three or more territories separated by not more than 1.5 miles. The groups should be spaced between 6 and 12 miles apart.

Excerpt from the Final Environment Impact Statement for the Pacific Southwest Regional Guide (continued)

- (c) Territories which cannot be grouped (due to natural geographic conditions) may be no more than 6 miles from adjacent groups of territories.
- (d) Territories within the groups may overlap 25%; however, core areas cannot overlap.
- (3) To the extent possible (i.e., while still meeting habitat needs), network territories will be located on lands not suitable for timber production or on lands already allocated to prescriptions compatible with spotted owl habitat needs (conditions).
- (4) Each Forest is responsible for providing suitable links to spotted owl habitats to adjacent National Forest lands (intra- and inter-Region) and to other Federal, State, and private lands currently having spotted owl habitats.
- (5) Validation of a Forest's spotted owl network by the Regional Office Wildlife Staff is required.
- e. During plan implementation, using the FORPLAN allocations/prescriptions, have a biologist and silviculturist jointly develop individual territory schedules and plans for management of the area for spotted owl habitat. This schedule and action plan will include:
  - (1) Identification of existing owl use areas and specific replacement stands.
  - (2) Specification of the composition and percent makeup of vegetation components to be managed for.
  - (3) Silvicultural prescriptions for each habitat area which will include proposed silvicultural systems, cutting methods and entry schedules, and rotations to achieve the habitat objectives.
- f. FORPLAN modeling rules:
  - (1) FORPLAN will be allowed to select the appropriate prescription or combination of prescriptions as well as the associated number or acres in each prescription needed to meet the habitat requirements.
  - (2) Pre-FORPLAN land allocations for spotted owl management will not normally be acceptable. The exceptions are when:
    - (a) The pre-FORPLAN allocation is technically or biologically necessary and no other reasonable choice is available;
    - (b) The pre-FORPLAN allocations can be shown to be cost-effective.
  - (3) For analysis purposes, the area within which Forests are to manage for spotted owl habitat that is no more than 1.5 miles from the center of the existing core will be delineated for each pair of owls.

## *The Alternatives*

Excerpt from the Final Environment Impact Statement for the Pacific Southwest Regional Guide (continued)

- (a) These areas will be analyzed collectively, not individually; that is, the trade-off analysis will be done in aggregate for all of the areas being managed for spotted owls.
- (b) To minimize opportunity cost distortions, do not assume that outputs and costs (trade-offs) come entirely from low site or entirely from high site lands. Use averages unless more specific data are available.
- (4) The full range of FORPLAN prescriptions that are capable of maintaining or creating suitable habitat for spotted owls will be used in the modeling process. This range of FORPLAN prescriptions will include the following guidelines:
  - (a) prescriptions in which no timber harvesting is scheduled or allowed;
  - (b) even-aged timber management prescriptions;
  - (c) uneven-aged timber management prescriptions (i.e., group selection).

## **Adjustment Process for Alternative A**

Forests in Oregon and Washington have completed Forest Land and Resource Management Plans, or "Forest Plans". To respond to changing conditions, these Forests will use the amendment and revision process of the NFMA planning regulations which includes environmental analysis to adjust the standards and guidelines.

Forests in northern California without completed Land and Resource Management Plans will continue to apply the existing Pacific Southwest Regional Guide standards and guidelines for management of northern spotted owl habitat. Once Forest Plans are completed, Forests responding to changing conditions will use the amendment and revision process of the National Forest Management Act (NFMA) planning regulations which includes environmental analysis to adjust the standards and guidelines.

In 1987 the Forest Service began coordinating ongoing inventories of spotted owl habitat and that year chartered the Spotted Owl Management, Research, Development and Application Program. The purpose of this program is to coordinate Forest Service research and management efforts on spotted owl biology and ecology. Forest Plan revisions or amendments will be considered as this program, or other monitoring as outlined in this environmental impact statement (see Appendix J), indicate the need.

**Implementation of Alternative A** If Alternative A is selected in the Record of Decision for this document, it will be implemented on site-specific projects and through Forest Plans.

In Oregon and Washington, forest managers will follow the direction in the approved Forest Plans.

In California, on National Forests where Forest Plans are yet to become final, the management direction will be incorporated in the forthcoming plans. Prior to the completion of these Forest Plans, the designated Spotted Owl Habitat Areas and the remaining forest lands will be managed in accordance with the standards and guidelines for Alternative A. Until Forest Plans can be completed for the northern California National Forests, the annual programmed timber harvest for these Forests will be adjusted to reflect the harvest implications of the management direction of this alternative.

In California, on National Forests where Forest Plans are approved and not consistent with this management direction, Forest Supervisors will amend their Forest Plans to become consistent with this management direction.

**Critical Habitat**

Critical Habitat will be managed as indicated in the section “Critical Habitat” at the beginning of this chapter.

This page left blank for notes.

## Elements Common to Alternatives B, C, and D

---

### Introduction

Alternatives B, C, and D include the Conservation Strategy developed by the Interagency Scientific Committee (ISC). These three alternatives vary by applying the standards and guidelines that apply to Habitat Conservation Areas to different areas in the National Forests.

The full implementation of the ISC Strategy, and the committee's assessment of owl viability, was based on the assumption that all Federal lands would be managed according to the ISC Strategy. However, the Forest Service has jurisdiction only on National Forest System lands. The management prescriptions in these alternatives apply only to lands administered by the Forest Service.

All three alternatives share definitions and standards and guidelines from the ISC Report (Thomas et al. 1990), and the three questions and answer documents on the Conservation Strategy (Mays and Mulder 1991b, Thomas 1991, and USDA Forest Service, 1991a). Those documents are incorporated by reference into this environmental impact statement. Copies are available from the address on the title page.

There are three central elements of each alternative: designated areas to provide nesting, roosting, and foraging habitat; guidelines to ensure distribution of dispersal habitat; and the establishment of an integrated inventory, monitoring, and research program to reduce scientific uncertainties and guide management. Each of these elements is key to managing habitat for the northern spotted owl.

The Category 1, 2, and permanent Category 3 Habitat Conservation Areas (HCAs) of this management direction are those which were delineated on the 1/2-inch to the mile maps sent to the Forest Service by the Interagency Scientific Committee. The maps were used by National Forest staffs as they implemented the direction in the Secretary's September 29, 1990, direction (55 FR 40412, October 3, 1990) to manage the National Forests "not inconsistent" with the ISC Conservation Strategy. The non-permanent Category 3 HCAs and Category 4 HCAs are those delineated in the course of implementing that same direction (Thomas 1991, Questions 15 through 17.)

The HCAs are mapped in Forest Service data bases and are in use for project planning and resource management on Ranger District and National Forest Supervisors' offices. These maps were used by the interdisciplinary team, and the map information was added to the

Common  
to  
B,C,D

## *The Alternatives*

Geographic Information System (GIS) data base (See Appendix B) for this environmental impact statement. These HCAs are displayed at a smaller scale than the original ISC maps on the folded alternative maps for Washington, Oregon, and California included with this document.

## **Standards and Guidelines**

As indicated in Appendix Q of the ISC Report, management of both the Habitat Conservation Areas and dispersal habitat within the Forest Matrix are governed by standards and guidelines.

The following excerpts are from the ISC's Conservation Strategy for the Northern Spotted Owl, Appendix Q: Standards and Guidelines, dated May 1990. Included are the definitions, and standards and guidelines for Habitat Conservation Areas and the dispersal habitat within the Forest Matrix (Thomas et al. 1990: 315-327).

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl

<b>Goals</b>	<ul style="list-style-type: none"><li>• Maintain, over the forest landscape, a population of northern spotted owls that has a high probability of continued existence throughout its range.</li><li>• Identify and protect, in the short term, key habitat areas and pairs of owls.</li></ul>
<b>Objectives</b>	<p>The following objectives are to be met within the proposed planning period of 50 to 100 years.</p> <ul style="list-style-type: none"><li>• Manage for continued distribution of breeding pairs throughout the owl's current range.</li><li>• Manage for restoration of breeding pairs in key areas of the owl's historic range.</li><li>• Manage habitat and owl distribution so that pairs and subpopulations of owls interact genetically and demographically, to minimize risks to long-term viability.</li><li>• Monitor and conduct research to evaluate whether the goals and objectives are being met and to facilitate adaptive management.</li></ul>
<b>Description of the Conservation Strategy</b>	<p>The following provides a description and outline of the conservation strategy.</p> <p><b>Definition:</b></p>
<b>Habitat Conservation Area (HCA)</b>	<p>A contiguous block of habitat to be managed and conserved for breeding pairs, connectivity, and distribution of owls. Application may vary throughout the range according to local conditions. A schematic diagram of the strategy is provided in figure Q1.</p> <p><b>Categories of HCAs (table Q1):</b></p> <ul style="list-style-type: none"><li>• Category 1-blocks of habitat to support at least 20 pairs.</li><li>• Category 2-blocks of habitat to support 2 to 19 pairs.</li><li>• Category 3-blocks of habitat to support individual pairs.</li><li>• Category 4-blocks of habitat that may be smaller than the median annual home-range size but provide connectivity or potential habitat for future nest sites.</li></ul>

## The Alternatives

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

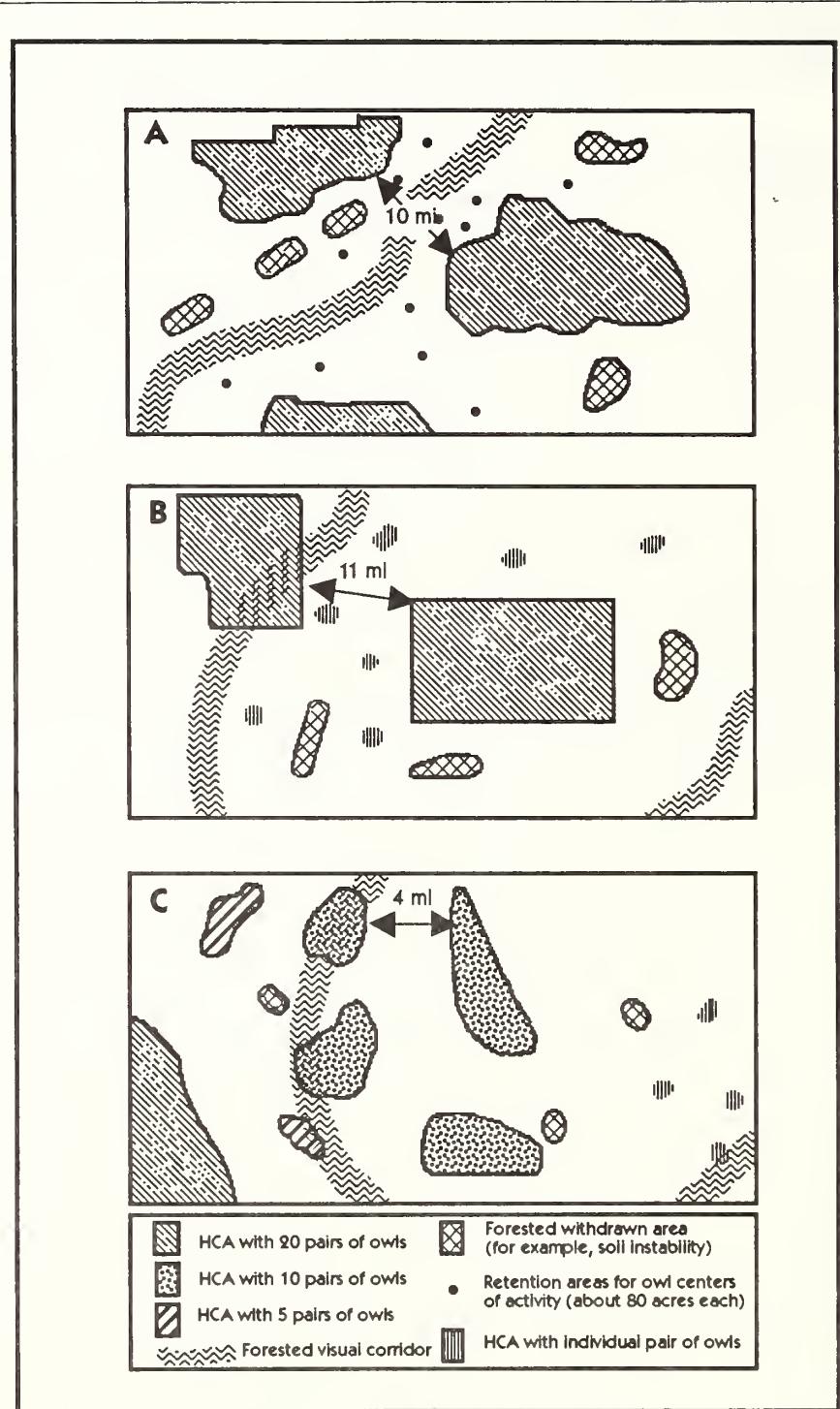


Figure Q1—Schematic drawings of the elements of the conservation strategy as it might apply to three different landscapes: scenarios for A, Category 1,  $\geq 20$  pairs of owls currently; B, Category 1,  $\geq 20$  pairs not currently present; and C, Categories 2 (2 to 19 pairs) and 3 (blocks to support individual pairs).

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

Table Q1--Description of categories

Strategy	Types
Habitat Conservation Area	
Categories <sup>a</sup> :	
1. Blocks of habitat to support $\geq 20$ pairs	(see figure Q1 and State maps)
2. Blocks of habitat to support $< 20$ pairs	(see figure Q1 and State maps)
3. Blocks of habitat to support individual pairs	a. Small blocks (delineated on State maps)
4. Blocks of habitat that may be smaller than median annual home-range size	b. Radius-based circle (not delineated on State maps) a. Small blocks (delineated) b. 80-acre retention areas (not delineated)
Forest Matrix	
Categories <sup>a</sup> :	
1. Lands suited for timber production:	
• Long rotations	Visual corridors, deer winter range, old-growth retention areas
• Intensively managed lands	Timber production lands
2. Lands unsuited <sup>b</sup> for timber production:	
• Allocation	Stream corridors
• Technical	Soil, regeneration problems
3. Reserved lands <sup>b</sup> outside HCAs:	Parks, Wilderness Area

<sup>a</sup>Categories are listed in order of importance to owls and availability of current or potential habitat.<sup>b</sup>Although most unsuited and reserved lands are too small or of insufficient quality to be considered part of individual HCAs, some low-elevation areas provide significant amounts of suitable habitat.**Intent:**

- To assure population viability by providing for long-term occupancy and by reducing risks of local isolation and extinction.
- To support a minimum of 20 pairs wherever possible.
- To provide for owl distribution throughout the range.
- To enhance habitat continuity and quality (that is, maintain the integrity of the interior forest environment).
- To mitigate or reverse local or regional adverse habitat or population trends.
- To hedge against catastrophic loss and adverse effects of timber management (for example, reduce edge effects, mitigate the likelihood of fire or wind effects).

## *The Alternatives*

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

### **Forest Matrix**

#### **Definition:**

- All forest lands outside of designated HCAs.

#### **Categories of Forest Matrix (table Q1):**

- Lands suited for timber production
- Lands unsuited for timber production
- Reserved lands

#### **Intent:**

- To provide connectivity for dispersal and interaction of owls among HCAs. See [reference omitted] for maps of portions of two National Forests that demonstrate connectivity between HCAs provided by the forest matrix.
- To maintain options for returning owls to the forest matrix by retaining older forest structures in the managed landscape.
- To develop and apply experimental silvicultural treatments that may support a viable owl population in the forest matrix.
- To contribute toward a short-term viable population (less than 50 years).

### **Guidelines Used in Delineating HCAs**

The following guidelines were used to establish the location, size, spacing, shape, and quality of individual HCAs on the enclosed State maps.

### **Location of Individual HCAs**

Location of individual HCAs was based on the following considerations:

- Land ownership (primarily on public lands).  
Note: Some HCAs are recommended for State, tribal, and private lands (dashed lines on State maps) [reference omitted].
- Current and future population distribution to assure viability.
- Occurrence of known pairs and availability of suitable habitat.
- Availability of, or potential for, sufficient pairs to support target densities.
- Ability of reserve lands to support owls.
- Inclusion of the full range of elevational gradients to maintain a diversity of habitats.
- Proximity to other HCAs (see spacing below).

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

**Size of Individual HCAs**

HCA size was based on the following considerations (see table Q2 for application):

- The ability of an area to support a minimum of 20 currently known<sup>1</sup> pairs, estimated, or expected based on the presence of pairs, single owls, or the amount of suitable habitat (Category 1).  
The size of the HCA was established by delineating an area to support the target number of pairs using median annual home-range and density information as a guide [reference omitted].
- The inability to support at least 20 pairs because of natural landscape limitations, limited availability of public lands, or local human-induced extirpation.  
The size of Category 2 HCAs (2 to 19 pairs) was established by delineating an area to accommodate as many known, estimated, or potential pairs as possible, using median annual home-range size [reference omitted].

---

<sup>1</sup>Currently known pair is defined as the presence of any pair observed during the past 5 years within the designated area.

## The Alternatives

### Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

Table Q2—Application of management strategies

Area	Location	HCA Categories
<b>WASHINGTON</b>		
Cascade Province (east and west):		
South Cascades	South of Mount Rainier	1,4 (retention areas)
North Cascades	North of Mount Rainier	2,4 (retention areas)
North Cascades/east	Wenatchee (Entiat and Chelan Ranger Districts) and Okanogan National Forests	
Columbia River Gorge	South of Gifford-Pinchot National Forest to river	3 (radius-based) 1
Olympic Peninsula	Olympic Peninsula	1,3 (radius-based)
Southwest Washington	South of Olympic Peninsula and west of Gifford Pinchot National Forest	1
<b>OREGON</b>		
Cascade Province (east and west):		
Cascade/west	California border to Mt Hood	1,2,4 (retention areas)
Columbia River Gorge	North of Mt Hood to river	1
Cascades/east	Deschutes National Forest (north of Bend)	2,4 (retention areas)
	Deschutes National Forest (south of Bend)	3 (radius-based)
Coast Range Province <sup>a</sup>	West of I-5 and north of Highway 38	1,2,3 (radius-based)
Klamath Province	Roseburg south into California	1,4 (retention areas)
<b>CALIFORNIA</b>		
Klamath Province:		
North Klamath Mountains	Yolla Bolly Wilderness north into Oregon	1,2,4 (retention areas)
South Mendocino NF	South of Yolla Bolly Wilderness	1,2,3 (mapped) 4 (retention areas)
Cascade/Modoc Province:		
Shasta/McCloud Region	East and north of Clair Engle Reservoir	2,3 (mapped and radius-based) 4 (mapped)
North Coast Range Province	West and south of National Forest	1,2,3,4 (mapped)

<sup>a</sup>For this table, part of the southern Coast Range between Highways 38 and 42 are included in the Klamath Province.

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

The size of Category 3 HCAs (single-pair HCAs) was determined either by (a) using the median annual home-range size (for HCAs delineated on the maps) or (b) using a radius to encompass the estimated home-range size for each State (for those HCAs not delineated on the maps—see Guidelines for Delineating Nonmapped HCAs later in this appendix).

The size of Category 4 HCAs (connector and retention areas) was determined either from (a) the availability of existing blocks under public ownership (for HCAs delineated on the maps) or (b) retention of at least 80 acres of suitable habitat around a known pair's center of activity (for those areas not delineated on the maps—see Guidelines for Delineating Nonmapped HCAs later in this appendix).

**Shape and Quality of HCAs**

The shape and quality of individual HCAs were based on the following considerations:

- Local topography and distribution of public lands.
- Provision of suitable habitat, or future capability to provide suitable habitat, with the structure and composition necessary to support the target number of pairs.
- Provision of contiguous suitable habitat within individual HCAs, given landscape constraints.

**Spacing between HCAs**

Spacing between individual HCAs was based on the following considerations:

- A maximum of 12 miles between Category 1 HCAs measured edge to edge [reference omitted].
- A maximum of 7 miles between Category 2 HCAs measured edge to edge [reference omitted].
- Spacing may be closer or farther for all categories of HCAs because of other circumstances or constraints (such as land ownership and landscape potential).

## *The Alternatives*

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

### **Guidelines to Use in Delineating Nonmapped HCAs**

Guidelines for agencies to use in delineating nonmapped HCAs (Category 3 radius-based HCAs and Category 4 retention areas) should consider the criteria stated earlier for mapped HCAs for shape and quality. Guidelines for location and size are explained below; spacing did not apply.

### **Management of Habitat for Individual Pairs (Category 3)**

Maintaining and recruiting suitable habitat around individual pairs is necessary in portions of the owl's range and is a further requirement of this strategy. These areas are to be retained regardless of changes in occupancy. For some Forests and BLM Districts, this requirement is in addition to other strategies (see table Q2 and [reference omitted]).

The following areas should establish Category 3 HCAs.

#### Washington:

Okanogan National Forest  
Wenatchee National Forest (Entiat and Chelan Ranger Districts)  
Olympic National Forest

#### Oregon:

Deschutes National Forest south of Bend  
Siuslaw National Forest  
BLM Districts north of Highway 38, west of I-5

#### California:

Shasta and Klamath National Forests north and east of  
Clair Engle Reservoir and north and east of mapped HCAs

#### Location

- Availability of existing suitable habitat.
- Occurrence of a known pair or both known and future pairs (for further discussion, see [reference omitted]).
- For those areas where protection outside of mapped HCAs is an additional requirement, the following applies:

Olympic Peninsula—protect all currently known pairs.

Oregon Coast Range (north of Highway 38)—protect all known and future pairs within a 12-mile-wide band around each HCA (measured from the edge) or half the distance to the next HCA if the distance is less than 12 miles.

Shasta/McCloud Area of Special Concern (north and east of Clair Engle Reservoir within the area of delineated HCAs)—protect all known and future pairs within a 12-mile-wide band around each Category 1 and 2 HCA (measured from the edge) or half the distance to the next Category 1 or 2 HCA if the distance is less than 12 miles; protect all known and future pairs in other areas until the possibility of improving the Category 3 situation in these areas can be assessed by the oversight committee established under this strategy.

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

Pairs outside of Category 1 and 2 HCAs should be protected until the number of pair areas outside the HCA, plus the number of known pairs within that HCA (as verified from 3 consecutive years of surveys), match the projected target for that HCA. The number of pair areas can be reduced proportionally as the number of pairs within the HCA approaches the target for that HCA according to the following formula:

$$\frac{(\text{target number of pairs}) - (\text{known number of pairs inside HCA})}{\text{number of pairs to be protected outside HCA}} =$$

Example: If the target number of pairs for an HCA is 20 and only 7 pairs are currently known within the HCA, then at least 13 pairs or the number of known pairs (up to 13 after completion of surveys) outside of the HCA must be protected. If three additional pairs are located within the HCA (verified from 3 consecutive years of surveys using standard protocols), the number of pairs (or pair areas) protected outside of the HCA can be reduced by three.

- Surveys are sometimes incomplete and present data insufficient to establish the presence of pairs of spotted owls.

In the Shasta/McCloud Area of Special Concern (north and east of mapped HCAs), surveys to verify the presence of pairs of owls must be conducted for 3 consecutive years. Category 3 HCAs should be established for all verified pairs and for the repeated presence (within one location) of single owls during this period, until the surveys are completed and the status of the owl population in this area can be determined by the committee established under this strategy.

#### Size

- Delineate an area of suitable habitat using a circle with a 2.1-mile radius in Washington, a 1.5-mile radius in Oregon, and a 1.2-mile radius California. Adjust the circle to include the pair's center of activity (nest site or primary roost area) and the best arrangement of suitable habitat; the center of activity should be at least 1/4 mile from the edge of the HCA, except where precluded by ownership boundaries or past logging.

Adjust boundaries, if necessary, to follow landscape configurations such as roads, streams, ridge tops, or previous sale boundaries, so long as suitable habitat encompassed by the original circle has not been reduced.

#### Retention Areas (Category 4)

Centers of activity for currently known pairs of owls will be retained in addition to the HCAs that have been delineated on the maps. These areas will provide potential nesting habitat during subsequent rotations and offer the opportunity to return owls to the forest matrix in the future.

## The Alternatives

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

### Location

- Occurrence of known pairs throughout the owl's range, except in those areas where the only strategy is protection of all known pairs.
- Not to exceed 7 pairs (areas) per township.

### Size

- Delineate the stand of trees containing the center of activity (nest site, principal roosting area, or both) and additional suitable habitat in the vicinity until at least 80 acres are designated or a distance of 1/4 mile from the center of activity is reached, whichever occurs first.
- The center of activity need not be located in the geometric center of the designated acres, given topographic features and availability of suitable habitat; the 80 acres should be as contiguous as possible.

### Management Prescriptions

The Committee believes the following management activities apply and need to be included in the conservation strategy. These management prescriptions apply to federally managed lands and are recommended for other land ownerships.

### Management Activities within the HCA

The HCA is the cornerstone of the conservation strategy. The success of the strategy depends on the habitat conditions in the HCAs. The following elements are important to ensure both short- and long-term viability of the northern spotted owl. To be consistent with the intent of this document, site-specific management plans must be developed for each Category 1, 2, or 3 HCA, explaining allowable, desired, and planned management activities in each area.

#### Inventorying and Monitoring

- Within 3 years, determine owl densities within each HCA.
- Conduct (or have conducted within the past 2 years) at least six owl survey visits with a minimum of three visits in any one year before harvest of all sales under contract and any sales placed under contract in FY90. If pair occupancy is confirmed, refer to Timber Management section that follows.
- Monitor demographic and habitat trends in replicated samples of HCAs in each physiographic province, including banding all owls in selected areas.

#### Timber Management

- Prohibit timber harvest of any age-class of forest, except:  
Sale units presently under contract that are more than 1/2 mile from the center of activity of a known pair. Modify sales or sale units that are within 1/2 mile of pairs;

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

Substitute sales outside the HCA for any currently planned but unsold timber sales for FY90. If substitution is not an option, follow the stipulations described above; and

Review proposals case by case to remove individual or small groups of trees for administrative needs (for example, hazard trees or rock pit expansion) or for other resource management programs (for example, campground developments).

- Allow silvicultural treatments that have been tested or demonstrated through experimentation to facilitate the development of suitable habitat, such as planting trees [reference omitted].
- Prohibit firewood cutting, except for removal of logging slash from previously awarded units that exceed the dead-and-downed component.
- Prohibit salvage of any downed or standing trees. For special situations where salvage of extensive areas may be proposed, salvage activities must be approved by the interagency body organized to review implementation of the conservation strategy.

#### Fire Management

- Prepare a fire-management plan for each HCA.

#### Road Construction

- Road construction diminishes the quality and amount of owl habitat. Roads should be located in HCAs only when no feasible alternative is possible. When roads are constructed, they should be located and engineered to minimize the loss and alteration of habitat and should be situated at least 1/4 mile from the activity center of any known pair.

#### Land Exchanges

- Prohibit exchange of forested lands from Federal ownership without approval of the interagency body organized to review implementation of the conservation strategy.
- Consider land exchanges to improve existing HCAs, especially in lands where public and private lands are intermingled (for example, BLM areas).

#### Mining Operations

- To determine effects on known pairs and suitable habitat, mining activities should be reviewed case by case for approval by the interagency body organized to review implementation of this conservation strategy.

## *The Alternatives*

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

<b>Management Activities Within the Forest Matrix Outside HCAs</b>	<p>Connectivity and retention of habitat characteristics for future breeding sites are important aspects of the conservation strategy in the long- and short-terms. To assure that adequate dispersal habitat and options to apply adaptive management are available in the forest matrix, the following prescriptions are required within the owl's range.</p> <p>Reserved Lands</p> <ul style="list-style-type: none"><li>• No decrease will be made in the present direction of management for all forested lands in this category.</li></ul> <p>Lands Unsuitable for Timber Production</p> <ul style="list-style-type: none"><li>• No decrease will be made in the present direction of management for all forested lands in this category.</li></ul> <p>Lands Suited for Timber Production</p> <ul style="list-style-type: none"><li>• Retain existing considerations for other resource values such as wildlife trees and downed-wood retention.</li><li>• Establish 80-acre retention areas (Category 4 HCAs) around known pairs as previously discussed (see Guidelines to Use in Delineating Nonmapped HCAs), where all known pairs are not otherwise delineated.</li><li>• For every quarter township, timber harvest shall be permitted only when 50% of the forest landscape consists of forest stands with a mean d.b.h. of 11 inches and a canopy closure of 40% (50-11-40 rule). All land-use allocations on forest lands (except Category 1,2, or 3 HCAs) and all ownerships within the quarter township contribute to meeting this rule.</li></ul>
--	---

## **50-11-40 Rule**

The paragraph immediately above is what has become known as the "50-11-40 rule." Further information on the implementation of this rule can be found in the three question and answer documents for the ISC Report (Mays and Mulder 1991b, Thomas 1991, and USDA Forest Service, 1991a). Questions 42 through 53 in the larger work (Thomas 1991) deal with the scientific basis for the rule and its general application. Questions 19 through 33 in the smaller paper (USDA Forest Service, 1991a) deal with the application of the rule on various types of forest, and contain advice on how to calculate the rule where different ownerships and forest conditions apply. (The rule applies only to Federal lands.)

Excerpt from ISC's Conservation Strategy for the Northern Spotted Owl (continued)

Steps:

The percentage of the forest landscape (minus acreage in any Category 1, 2, or 3 HCA) is computed to meet the 50-11-40 rule for the quarter township where the proposed action is located.

Where the quarter township contains multiple ownerships, the percentage is computed separately for each owner, based on the amount of ownership.

Example: If owner A has 2880 acres in the quarter township, it would have a 1440-acre quota under the 50-11-40 rule before harvest would be permitted. If owners B and C each had 1440 acres, their quota under the rule would be 720 acres of forest stands, each with a mean d.b.h. of 11 inches and a 40% canopy closure.

Prorated quotas will be required for 3 years after the implementation of the conservation strategy. At the end of the 3-year period, the interagency body appointed to oversee the plan's implementation will re-evaluate the 50-11-40 rule as it applies in multiple-ownership areas.

- We recommend experimentation and testing of silvicultural treatments that improve, maintain, or develop suitable habitat over time [reference omitted]. A long-term goal is to provide an opportunity for owls to occur in the managed forest matrix at populations sufficient to warrant review of the need to continue HCAs.

## Adjustment Process for Alternatives B, C, and D

For a set of management prescriptions to be successful they must be capable of being adjusted to meet changing circumstances and to be fine tuned to meet the situation encountered. The Interagency Scientific Committee recognized this in their report by including "Adaptive Management" as a recommendation and as an Appendix (Thomas et al. 1990. 40; 345-364).

Each of the alternatives considered in this environmental impact statement encourages studies to determine the effectiveness of the standards and guidelines in providing for spotted owl population viability. Under any of the alternatives, this is best accomplished through an integrated program of inventory, monitoring, and research. The framework for this program is presented in Appendix J, Monitoring Plan.

Conducting inventories, monitoring habitat, and continuing research studies do not by themselves ensure future conservation of the subspecies and its habitat. This new information will be used in a process of reevaluating the management standards and guidelines to determine:

## *The Alternatives*

- if the responsible management offices are indeed implementing the guidelines as stipulated,
- if forest vegetation and spotted owl populations are responding as anticipated to the management directed in the guidelines, and
- if the key assumptions underlying the guidelines are sound.

The new information will be compared to expected results. This will aid in assessing whether various aspects of the guidelines should be maintained, relaxed, or strengthened. This process of gathering new information, reevaluating guidelines, and updating the management direction is called adaptive management.

Adaptive management is successful if:

- options for changing management direction (such as increasing or decreasing the number of HCAs or changing the management direction within HCAs) actually exist over time on the land.
- the administrative and biological systems (habitats and populations) can be monitored over time in a cost-effective manner, and
- there is a formal process in place that calls for technical analysis of the new data and administrative reassessment of management direction.

## **Technical Review Team**

An interagency Technical Review Team was established in the letter of November 9, 1990, from U.S. Fish and Wildlife Service Regional Director Marvin L. Plenert to members of the Interagency Northern Spotted Owl Conservation Group. The latter group consists of: Bureau of Land Management State Directors from California and Oregon; the U.S. Fish and Wildlife Service Regional Director; Forest Service Regional Foresters from the Pacific Northwest and Pacific Southwest Regions; Station Directors from the Pacific Northwest and Pacific Southwest Research Stations; National Park Service Regional Directors from the Pacific Northwest and Western Regions; wildlife agencies from Oregon and Washington and the Natural Resources Agency from California.

The Technical Review Team is a working group that is co-chaired by Forest Service and U.S. Fish and Wildlife Service members with technical knowledge from those agencies plus Bureau of Land Management, National Park Service, California Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Wildlife.

Its work to date has been focused on interpreting the ISC Conservation Strategy, and this team has issued or contributed to a series of questions and answers relating to the ISC Strategy (Thomas 1991a, 1991b, and Mays and Mulder 1991b). The Technical Review Team can review proposals referred to them from member agencies to determine consistency with the ISC Strategy.

**Implementation of Alternative B, C, or D**

If Alternative B, C, or D is selected in the Record of Decision for this document it will be implemented on lands administered by the Forest Service within the range of the northern spotted owl.

The implementation process that will be used to insure consistency of habitat management in accordance with the areas and the standards and guidelines prescribed in these alternatives will be the process used by the Forest Service to meet the requirements of the National Environmental Policy Act (NEPA). A proposed action is subject to the environmental analysis, and the public notification and involvement of the NEPA process. These Forest Service decisions are commonly subject to the Forest Service Administrative Review (Appeal) regulations 36 CFR 217. There will also be, as appropriate, consultation with the U.S. Fish and Wildlife Service under the procedures of the Endangered Species Act, Section 7(a).

**Steering Committee and Oversight Team**

For proposed actions involving issues about spotted owl habitat or spotted owls, the NEPA process will be supplemented by a Steering Committee and an Oversight Team which will evaluate the proposed action for consistency with the management direction for spotted owl habitat.

In his December 30, 1991, letter, Forest Service Deputy Chief James Overbay established a Steering Committee and an Oversight Team to insure consistent implementation of current and future management direction for northern spotted owl habitat. The Steering Committee consists of the two Regional Foresters and the two Station Directors from the affected Regions and Experiment Stations. The Oversight Team consists of a team leader, a scientist with spotted owl research experience, biologists with expertise in threatened and endangered species, a silviculturist, and other specialists as needed.

The Oversight Team will evaluate the proposed forest management activities and projects affecting spotted owl habitat for their consistency with Forest Service standards and guidelines for management of northern spotted owl habitat. Their evaluation and recommendation will be reported to the Steering Committee which will then determine if the proposal is consistent with management direction and should be considered further at the appropriate decision-making level using the NEPA process. The Oversight Team will also maintain information on proposals and on the biology, habitat, and habitat management of the northern spotted owl; coordinate with other agencies and teams, including the Technical Review Team; and evaluate proposals for adjustments to the management direction.

## *The Alternatives*

### **In Oregon and Washington**

On National Forests with lands within the spotted owl's range in Oregon and Washington, the Forest Plans will be amended by the Record of Decision for this environmental impact statement with the standards and guidelines presented in the selected alternative. The annual quantity of timber offered for sale will reflect the harvest implications of the standards and guidelines and the designated areas of the alternative selected.

Projects will be conducted under the standards and guidelines of the selected alternative. Standards and guidelines and management direction in Forest Plans not directly superseded by the selected alternative will remain in effect. The Spotted Owl Habitat Areas (SOHAs) of Forest Plans, if not subject to management under standards and guidelines for Habitat Conservation Areas, will revert to management under Forest Matrix prescriptions and the Forest Plan management direction (normally that of the surrounding management area) using the Forest Plan amendment and NEPA processes. The Oversight Team will evaluate proposals where superseding management prescriptions are not clear.

Implementation of revised management direction for northern spotted owl habitat may have effects on other goals and objectives in the Forest Plans that can not be evaluated at this time. The National Forests will monitor the effects of the standards and guidelines and the effects of the designation of areas managed primarily for northern spotted owl habitat on environmental conditions, outputs, and services to identify further adjustments that may need to be considered in subsequent Forest Plan amendments or revisions.

The U.S. Fish and Wildlife Service is expected to issue a Recovery Plan for the Northern Spotted Owl by mid-1992. When Forest Service objectives under the Recovery Plan have been identified, each affected National Forest will be directed to reevaluate the effect of management direction for northern spotted owl habitat on Forest-level programs and evaluate the need to amend or to revise its Forest Plan.

Revised management direction for northern spotted owl habitat will be incorporated into the Forest Plans immediately to guide project-level planning. The effects of management requirements for the spotted owl on the long-term relationship between levels of multiple-use goods and services provided by each affected National Forest can be evaluated after the Recovery Plan is issued. Action will then be taken as necessary to further amend or revise the Forest Plans as appropriate. Thus, the direction in the selected alternative will be in place until a long-term strategy for management of spotted owl habitat is adopted following the Recovery Plan.

## **In California**

On National Forests with lands within the spotted owl's range in California, until Forest Plans are completed, the standards and guidelines in the selected alternative will directly apply to projects in designated areas managed primarily for spotted owl habitat described in the selected alternative, and in lands suitable for timber production.

The standards and guidelines and the designated areas managed primarily for spotted owl habitat in the selected alternative will be incorporated into the Forest Plans which are being developed. Until the Forest Plans are completed, the annual quantity of timber offered for sale will reflect the harvest implications of the standards and guidelines and the designated areas of the alternative selected.

For those National Forests administering lands within the range of the northern spotted owl with approved Forest Plans, management direction will be adjusted as directed in the preceding section "In Oregon and Washington".

This page left blank for notes.

# Alternative B (Proposed Action)

## Interagency Scientific Committee (ISC) Conservation Strategy

### Introduction

This alternative would apply the Conservation Strategy presented by the Interagency Scientific Committee in their 1990 report: "A Conservation Strategy for the Northern Spotted Owl," to National Forests within the range of the northern spotted owl (Thomas et al. 1990).

The preferred alternative is Alternative B, the Interagency Scientific Committee's Conservation Strategy. If selected, this alternative would apply only to lands administered by the Forest Service.

#### Designated Areas Managed Primarily for Owl Habitat:

Habitat Conservation Areas (HCAs)

B

#### Lands Outside Designated Areas Managed Primarily for Owl Habitat:

For Dispersal Habitat,  
50-11-40 Rule<sup>1</sup> Applies to  
Lands Suited for Timber Production

<sup>1</sup> For definition of the 50-11-40 rule see "Elements Common to Alternatives B, C, and D" in this Chapter.

*The Alternatives*

<b>Standards and Guidelines</b>	The standards and guidelines for Habitat Conservation Areas and the Forest Matrix, as presented in the section “Elements Common to Alternatives B, C, and D,” apply to this alternative.
<b>Adjustment Process</b>	The adjustment process for Alternative B consists of the procedures outlined in the previous section “Elements Common to Alternatives B, C and D.”
<b>Implementation</b>	Alternative B will be implemented as indicated in the previous section, “Elements Common to Alternatives B, C, and D.”
<b>Critical Habitat</b>	Critical Habitat will be managed as indicated in the section “Critical Habitat” at the beginning of this chapter.

# Alternative C

## ISC Conservation Strategy Plus Critical Habitat Units

### Introduction

This alternative would apply the Conservation Strategy presented by the Interagency Scientific Committee in their 1990 report: "A Conservation Strategy for the Northern Spotted Owl," to National Forests within the range of the northern spotted owl. The standards and guidelines for Habitat Conservation Areas (HCAs) would apply to HCAs and to the Critical Habitat Units identified by the U.S. Fish and Wildlife Service in their January 1992 final rule.

**Designated Areas Managed Primarily for Owl Habitat:**

**Habitat Conservation Areas (HCAs)  
Plus Critical Habitat Units**

**Lands Outside Designated Areas Managed Primarily  
for Owl Habitat:**

**For Dispersal Habitat, 50-11-40 Rule<sup>1</sup>  
Applies to Lands Suited for  
Timber Production**

**C**

<sup>1</sup> For definition of the 50-11-40 rule see "Elements Common to Alternatives B, C, and D" in this Chapter.

## **Standards and Guidelines**

The standards and guidelines for Habitat Conservation Areas and the Forest Matrix which were presented in the section “Elements Common to Alternatives B, C, and D” apply to this alternative. Habitat Conservation Areas and all units proposed as Critical Habitat would be managed according to the standards and guidelines for Habitat Conservation Areas in the ISC Report. Standards and guidelines for the Forest Matrix would apply to the remaining forested land.

The U.S. Fish and Wildlife Service noted: “Designation of Critical Habitat does not offer specific direction for managing owl habitat. That type of direction, as well as any change in direction, will come through the administration of other facets of the Act (e.g., Section 7, HCP process [Habitat Conservation Plan process under Section 10 of the Act], and recovery planning) or through the development of land management plans addressing the owl,” (56 FR 40013). Because of the absence of clear requirements for management in Critical Habitat Units, and to examine a more protective management regime for the owl, this alternative applies the standards and guidelines for HCAs to Critical Habitat Units outside HCAs.

## **Adjustment Process**

The adjustment process for Alternative C consists of the procedures outlined in the earlier section “Elements Common to Alternatives B, C and D.”

**Implementation** Alternative C will be implemented as indicated in the earlier section, “Elements Common to Alternatives B, C, and D.”

## **Critical Habitat**

In Alternative C, the Critical Habitat is managed according to the standards and guidelines for HCAs.

## Alternative D

### ISC Conservation Strategy Plus All Spotted Owl Nesting, Roosting, and Foraging Habitat

#### Introduction

This alternative would apply the Conservation Strategy presented by the Interagency Scientific Committee in their 1990 report: "A Conservation Strategy for the Northern Spotted Owl," to National Forests within the range of the northern spotted owl. The standards and guidelines for Habitat Conservation Areas (HCAs) would apply to HCAs and to all nesting, roosting, and foraging habitat.

Designated Areas Managed Primarily for Owl Habitat:

Habitat Conservation Areas (HCAs)  
Plus All Spotted Owl  
Nesting, Roosting,  
and Foraging Habitat

Lands Outside Designated Areas Managed Primarily for Owl Habitat:

For Dispersal Habitat,  
50-11-40<sup>1</sup> Rule Applies to  
Lands Suited for Timber Production<sup>1</sup>

D

<sup>1</sup> For definition of the 50-11-40 rule see "Elements Common to Alternatives B, C, and D" in this Chapter.

*The Alternatives*

**Standards and Guidelines**

The standards and guidelines for Habitat Conservation Areas and the Forest Matrix which were presented in the section “Elements Common to Alternatives B, C, and D” apply to Alternative D.

In Alternative D the portion of the designated areas managed primarily for spotted owl habitat that is outside of the Habitat Conservation Areas contributes to meeting the 50-11-40 rule.

**Adjustment Process**

The adjustment process for Alternative D consists of the procedures outlined in the earlier section “Elements Common to Alternatives B, C, and D.”

**Implementation** Alternative D will be implemented as indicated in the earlier section, “Elements Common to Alternatives B, C, and D.”

**Critical Habitat**

Critical Habitat will be managed as indicated in the section “Critical Habitat” at the beginning of this chapter.

## Alternative E

### “Multi-Resource Strategy”

---

#### Introduction

This alternative would apply “A Multi-Resource Strategy for Conservation of the Northern Spotted Owl” to National Forests within the range of the northern spotted owl. This strategy was developed by the Spotted Owl Subgroup of the Wildlife Committee of the National Forest Products Association and American Forest Council. It is included in its entirety as Appendix K in this environmental impact statement. The standards and guidelines and mapping criteria were developed by this same subgroup in November 1991 and its areas, connecting habitat, and zones were mapped on November 15, 1991, by this subgroup using Forest Service base maps, Forest Plan allocations, and spotted owl location maps. A final draft of the strategy was received by the interdisciplinary team on December 9, 1991.

This strategy was announced in September 1991. It was first presented to the interdisciplinary team for this environmental impact statement on October 7, 1991. The interdisciplinary team received a large number of comments at public hearings and in written responses requesting that the Multi-Resource Strategy be evaluated as an alternative in the Final Environmental Impact Statement. Since it is essentially a variation of the other alternatives considered in the Draft Environmental Impact Statement, expands on alternatives suggested by the Northwest Forestry Association during scoping, and is qualitatively within the spectrum of alternatives discussed in the Draft, it is offered as an alternative in the Final Environmental Impact Statement rather than in a supplement to the Draft.

**Designated Areas Managed Primarily for Owl Habitat:**

**Reserved, Deferred, and Research  
Multiple-Pair Areas (MPAs)**

**Designated Areas Managed for Owl Habitat  
and Other Resources:**

**Connecting Habitat  
Owl Management Zone**

**Lands Outside Designated Areas:**

**No Specific Management for  
Owl Habitat**

**Standards and  
Guidelines**

The standards, guidelines and map for this alternative were developed by the Spotted Owl Subgroup of the Wildlife Committee of the National Forest Products Association and American Forest Council, and were presented to the Forest Service interdisciplinary team for this environmental impact statement on November 15, 1991.

The following excerpts are from the Multi-Resource Strategy. Included are the definitions and standards and guidelines for Multiple-Pair Areas, Connecting Habitat, and Owl Management Zone (see Appendix K).

Excerpt from Multi-Resource Strategy: Standards and Guidelines

<b>Goals</b>	<ul style="list-style-type: none"> <li>Maintain, over the forest landscape, a continuous, interbreeding population of northern spotted owls. Such a population has a very high probability of continued existence in both the short and long term. The research, integrated into this strategy, will be used to improve these standards and guidelines.</li> </ul>
<b>Objectives - Short Term</b>	<ul style="list-style-type: none"> <li>Establish a system of well distributed reserved and deferred habitat and management guidelines which insures the long and short term viability of the species and maintains or enhances long term management options for the owl.</li> </ul>
<b>Objectives - Long Term</b>	<ul style="list-style-type: none"> <li>Manage for a continuous distribution of interbreeding pairs of owls. Manage habitat and owl distribution so that pairs and sub-populations of owls interact genetically and demographically, to minimize risks to long-term viability.</li> <li>Conduct research to clarify habitat use and relationships, and to define silvicultural practices which enhance or maintain habitat used by the owl as well as produce new habitat in the shortest time possible.</li> <li>Conduct research and monitor to evaluate whether the goals and objectives are being met.</li> <li>Incrementally modify the strategy in terms of land classifications and management prescriptions as new research information warrants.</li> </ul>
<b>Description of the Multi-Resource Strategy</b>	The following provides a description and outline of the Multi-Resource Strategy.
<b>Multiple-Pair Areas (MPAs)</b>	<p><b>Definition:</b>  A contiguous block of habitat to be managed for multiple interbreeding pairs of northern spotted owls. Application varies throughout the range based on differences in physiographic provinces, local conditions and MPA type.</p> <p><b>Types of MPAs:</b></p> <ul style="list-style-type: none"> <li>Reserved MPAs - blocks of habitat where timber harvest is precluded which in combination with Deferred MPAs, will each support at least 20 pairs in Oregon and Washington and 10 pairs in California.</li> <li>Deferred MPAs - blocks of habitat that by themselves or in combination with Reserved MPAs will each support at least 20 pairs in Oregon and Washington and 10 pairs in California. In these areas timber harvest will be temporarily precluded.</li> <li>Research MPAs - blocks of habitat that will each support at least 15 pairs in Oregon and Washington and 10 pairs in California to be used in an integrated research effort.</li> </ul>
<b>Connecting Habitat</b>	<p><b>Definition:</b>  A band of habitat between Deferred and Reserved MPAs equal to twice the width of the average annual home range.</p>

## *The Alternatives*

Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

<b>Central Secure System Habitat</b>	<p><b>Intent:</b></p> <ul style="list-style-type: none"><li>• To support additional breeding pairs in a managed network of nesting, roosting, and foraging (NRF) habitat and dispersal habitat.</li><li>• To provide connectivity between Deferred and Reserved MPAs.</li></ul> <p><b>Definition:</b></p> <p>A band of forest providing for a continuous, well distributed, population of breeding pairs of owls. It is comprised of all Reserved and Deferred MPAs plus Connecting Habitat.</p>
	<p><b>Intent:</b></p> <ul style="list-style-type: none"><li>• To insure population viability by providing for long term occupancy and by minimizing risks of local isolation and extinction.</li><li>• To support a continuous well distributed population of interbreeding pairs within a network of 10- to 20+ pair areas connected by few-pair areas.</li><li>• To maintain or enhance habitat continuity and quality.</li><li>• To maintain or enhance local or regional population levels.</li><li>• To hedge against catastrophic loss.</li><li>• To provide for genetic and demographic interaction of owls.</li></ul>
<b>Owl Management Zone: Oregon and Washington</b>	<p><b>Definition:</b></p> <p>All lands outside the MPA and Central Secure System and inside the area defined on the map, within which owls and their habitat will be actively managed.</p> <p><b>Intent:</b></p> <ul style="list-style-type: none"><li>• To take advantage of the inherent variability in site (habitat) conditions and the owl's variable use of those elements for the maintenance and enhancement of dispersal habitat.</li><li>• To clearly identify the area necessary to be managed for the short and long term viability of the species.</li><li>• To provide habitat for dispersing owls, occasional pairs, and a floater population.</li><li>• To gain experience with site-specific modifications in forest practices.</li></ul>
<b>Owl Management Zone: California</b>	<p><b>Definition:</b></p> <p>All lands outside the MPA and Central Secure System and east of the coastal private lands, and inside the area defined on the map, within which owls and their habitat will be actively managed.</p> <p><b>Intent</b></p> <ul style="list-style-type: none"><li>• To develop and maintain a continuous distribution of habitat capable of supporting breeding pairs of owls.</li></ul>

Excerpt from Multi-Resource Strategy: Appendix E (in Appendix K, this document)

## MAPPING CRITERIA

The following criteria were used to map the Multiple Pair Areas, Connecting Habitat, and Owl Management Zones identified in this Alternative.

### IDENTIFY CURRENT STATUS OF HABITAT AND OWL LOCATIONS

1. Identify all nesting, roosting, and foraging (NRF) habitat that is within congressionally set-aside areas.
2. Identify all NRF habitat within areas identified as non-suitable for timber production in the selected alternative of the final forest plans, or draft plan if the final is not available.
3. Identify all lands which are not capable of growing NRF or dispersal habitat.
4. Identify all known locations of pairs and resident owl singles.

### DETERMINE THE MINIMUM SIZE OF THE MULTIPLE PAIR AREAS (MPAs)

The size of areas capable of supporting 10, 15 and 20 pairs is determined using the procedures documented on page 198 of the ISC Strategy. These are listed in Appendix C of the Multi-Resource Strategy (MRS).

### MAP THE MULTIPLE PAIR AREAS

Starting at the US-Canadian border, define areas large enough to support a minimum of 20 pairs per area in Oregon and Washington and 10 pairs per area in California that are no further than 15 miles apart in Oregon and Washington and 12 miles apart in California. Every effort should be made to incorporate as many known pairs and resident singles as possible.

Select lands within congressionally and administratively withdrawn areas making sure that at least 40% of the area is currently NRF habitat and that the majority of the remaining area is capable of growing into NRF or dispersal habitat. Incorporate the maximum number of known pairs and single owls possible.

Next include land within areas which have been assigned in the final forest plans as Regulation Class 3 (long rotation) using the same criteria as above.

Last include areas in Regulation Classes 1 and 2 using the same criteria as above.

### MAP THE RESEARCH MPAs

The actual number and locations of research areas will be determined by the Research Committee. For the purposes of this analysis, the following criteria were utilized recognizing that other configurations exist.

1. Areas must be large enough to support 15 pairs per area in Washington and Oregon and 10 pairs per area in California.

## *The Alternatives*

Excerpt from Multi-Resource Strategy: Appendix E (in Appendix K, this document)(continued)

2. Areas should be between 7 and 15 miles from the central secure system or another Research MPA in Oregon and Washington and 5 and 12 miles in California.
3. Areas must contain at least 40% NRF habitat.
4. Areas should currently contain at least 10 pairs or resident singles per area in Oregon and Washington and 7 pairs or resident singles per area in California whenever possible.
5. Each province must have at least one Research MPA.

Excerpt from Multi-Resource Strategy: Appendix E (in Appendix K, this document)(continued)

### **MAP THE CENTRAL SECURE SYSTEM**

1. Connect the Reserved and Deferred MPAs with a band of land equal to twice the diameter of the average annual home range size by province.
2. Map this to include the maximum amount of current NRF habitat and owl pairs and resident single.

### **MAP THE OWL MANAGEMENT ZONE**

1. Within Oregon and Washington, define the owl management zone as that area necessary to enclose all MPA's
2. Within California the zone includes all lands within the owl's range east of the coastal private lands.

Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

#### **Management Prescriptions**

The following are the management prescriptions that will be applied to the areas identified in this alternative.

#### **The Research Committee**

Within one year a committee (the "Research Committee") comprised of Forest Service, BLM, State, university, and independent scientists will design and implement an integrated research and monitoring program to clarify habitat use and relationships in order to define silvicultural practices that enhance or maintain habitat used by the owl.

## Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

<b>Reserved MPAs</b>	<ul style="list-style-type: none"> <li>• No change will be made in the present direction of management for all forested lands in this category.</li> </ul>
<b>Deferred MPAs</b>	<p><b>Timber Management</b></p> <ul style="list-style-type: none"> <li>• Prohibit timber harvest of any age-class of forest, except activities demonstrated through experimentation to facilitate the development of suitable habitat and approved by the Research Committee. These could include:</li> <li>– Pre-commercial and commercial thinnings where such activities would shorten the time required for such stands to reach suitability for dispersal, forage, roosting or nesting habitat.</li> <li>– Salvage of blowdown timber in excess of that needed to provide for prey habitat if such salvage can be accomplished in such a way which does not disturb owl activity or alter existing habitat conditions. This activity must be approved by the Research Committee.</li> <li>– Salvage of catastrophic standing dead timber to the extent it is in surplus of that needed to provide nesting components of future nesting habitat.</li> </ul>
	<p><b>Fire Management</b></p> <ul style="list-style-type: none"> <li>• Review existing fire management plans for compatibility with MPA objectives.</li> </ul>
	<p><b>Road Construction</b></p> <ul style="list-style-type: none"> <li>• Except as determined compatible through research, new roads should be located in MPAs only when no feasible alternative is possible. When roads are constructed, they should be located and engineered to minimize the loss and alteration of existing nesting habitat. Roads should be situated at least <math>\frac{1}{4}</math> mile from the activity center of any known active pair.</li> <li>• Existing road systems can be left open and maintained to a standard consistent with the other resource uses of the area, i.e. recreation, hunting, etc.</li> </ul>
	<p><b>Land Exchanges</b></p> <ul style="list-style-type: none"> <li>• Allow exchange of forested lands from Federal ownership or acquisition of private ownership only after consultation with the Research Committee.</li> </ul>
	<p><b>Mining Operations</b></p> <ul style="list-style-type: none"> <li>• Mining operations which disturb small acreages of forested land are allowed as long as they do not disturb any habitat within <math>\frac{1}{4}</math> mile from an active activity center and comply with the other standards and guidelines of this area.</li> </ul>
<b>Research MPAs</b>	<ul style="list-style-type: none"> <li>• All standards and guidelines for Deferred MPAs apply to Research MPAs except as modified by the Research Committee.</li> </ul> <p>(For analysis purposes, assume the area in nesting roosting, and foraging habitat will not decrease more than 20% from amounts that would be found if the area were a Deferred MPA.)</p>

Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

**Connecting Habitat**

**General Guidelines**

- Each watershed, or portion thereof, within this area will be managed to maintain nesting, roosting, foraging and dispersal habitat to support additional breeding pairs.
- The amount of NRF habitat needed in each area varies. In areas of sharp contrast in forest cover (very young non-suitable habitats vs. only mature and old growth stands) the minimal amount of such habitat appears to be 30%. In areas with a greater mix of successional stages, 30-50% of the area may need to be in a suitable condition.
- Take advantage of the inherent variability in site (habitat) conditions and the owl's variable use of those elements for the maintenance and enhancement of dispersal habitat.
- Retain present nesting structures as they exist. Plan for the replacement of these features as needed.
- Limit openings between nesting, roosting, and foraging habitat or dispersal habitat to 1000 feet.
- Survey and inventory entire area to determine location, occupancy, and status of all existing owls using extensive inventory techniques.

**Resource Management**

- No vegetative management activities will be allowed within 1/4 mile of actively nesting pairs, *i.e.*, during the nesting period.
- All forms of resource management are allowed as long as they comply with the other standards and guidelines applying to this area. Management plans should be designed to enhance the future development of owl habitat.

**Timber Management**

- Active timber management programs will be conducted with regard to the objectives for maintenance and creation of spotted owl habitat for nesting, roosting, foraging and dispersal.
- Integrate ("feather") stream, lake and other wetland protection zones into upslope prescriptions.
- Where an understory or midstory of hardwoods contributes to the habitat suitability of the stands and landscapes, prescriptions should provide for retention of that tier until final regeneration harvest. Ensure that future developing stands contain this hardwood component.
- Thinnings should be considered where canopy closure is >80% or where understory is excessively dense. Thin to provide clearance for flight and access to prey and increase crown volume and tree diameter.
- Design prescriptions to increase the percentage of overall canopy cover and habitat diversity within a watershed. Owl habitat should probably have at least 40% canopy cover, and not more than 80% canopy cover.
- Silvicultural practices such as seedtree, shelterwood, or selective harvesting should be emphasized where practical.
- When using seedtree or shelterwood prescriptions, modify their implementation as follows:
  - Do not schedule seedtree or shelterwood for harvest at the overstory removal step. Include site preparation and planting with genetically superior stock to ensure sound regeneration.

Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

- In coastal redwoods, uneven-aged systems should emphasize group selection to maintain intolerant and stump sprouting species. Maintain groups of trees with mistletoe to promote potential nest sites.

#### Fire Management

- Retain standing and down, dead woody material in harvest units. Where possible plant through slash. Utilize slash burning prescriptions that maintain as much of the 100- and 1,000-hour timelag fuels as possible.
- Prescriptions should be developed to interrupt continuity of fuels (both horizontally and vertically) especially in the Klamath Province and the east side of the Cascades.

#### Owl Management Zone, Oregon and Washington (except Siuslaw)

##### General Guidelines

- Take advantage of the inherent variability in site (habitat) conditions and the owl's variable of use those elements for the maintenance and enhancement of dispersal habitat. Each watershed (approx. 5,000 to 10,000 acres) should contain at least 40% habitat suitable for dispersal. Dispersal habitat should have 40% canopy cover with clearance under the canopy averaging greater than 20 feet.

#### 40-20'-40 Rule

The above paragraph is referred to elsewhere in this environmental impact statement as the "40-20'-40 rule".

Excerpt from Multi-Resource Strategy: Standards and Guidelines (continued)

#### Timber Management

- Active timber management programs will be conducted, but will be implemented with regards to the objectives for maintenance of spotted owl habitat for dispersal.
- Retain 70 acres of NRF habitat around active nest sites up to 3 per township and associated with dispersal habitat.
- Integrate ("feather") stream, lake and other wetland protection zones into upslope prescriptions.

#### Fire Management

- Retain standing and down, dead woody material in harvest units. Where possible plant through slash. Utilize slash burning prescriptions that maintain as much of the 100- and 1,000-hour timelag fuels as possible.

#### Owl Management Zone, Siuslaw National Forest

##### General Guidelines

- Apply the same management prescriptions as in Connecting Habitat.

<b>Owl Management Zone, California</b>	<b>General Guidelines</b> <ul style="list-style-type: none"><li>• Apply the same management prescriptions as in Connecting Habitat.</li></ul>
<b>Management Outside of the Owl Zone</b>	<b>General Guidelines</b> <ul style="list-style-type: none"><li>• On Federal lands, no specific owl management direction. Follow existing land management plans for other resources.</li></ul> <b>Management</b> <ul style="list-style-type: none"><li>• On other than those managed by federal agencies, develop and implement strategies from site specific plans to regional habitat management strategies.</li></ul>

## **Adaptive Management**

For a set of management prescriptions to be successful, they must be capable of being adjusted to meet changing circumstances and to be fine-tuned to meet the situation encountered and to respond to new research and monitoring information. The Spotted Owl Subgroup of the Wildlife Committee of the National Forest Products Association and American Forest Council recognized this in their report by including “Adaptive Management” as a recommendation and a section (NFPA/AFC, 1991:28-30, or Appendix K, this document).

## **The Research Committee**

As stated in the standards and guidelines for the Multi-Resource Strategy, “Within one year a committee (the ‘Research Committee’) comprised of Forest Service, BLM, State, university, and independent scientists will design and implement an integrated research and monitoring program to clarify habitat use and relationships in order to define silvicultural practices that enhance or maintain habitat used by the owl” (NFPA/AFC, 1991:13, also Appendix K, this document).

Management activities in all areas of the National Forests within the Central Secure System and the Owl Management Zones which require a change or any variance from the standards and guidelines of this alternative will be reviewed by the Research Committee. Management direction for Research Multiple-Pair Areas will be designed by the Research Committee.

The adjustment process that will be used to examine and possibly make changes to the areas and the standards and guidelines prescribed in these alternatives will be the process used by the Forest Service to implement the National Environmental Policy Act (NEPA). A proposed action is subject to the environmental analysis, and the public notification and involvement, of the NEPA process. If a proposed action involves a need to modify or clarify these standards and guidelines for the spotted owl, the Research Committee would

be asked to review the proposal and its alternatives for consistency with the overall Multi-Resource Strategy. There will also be, as appropriate, consultation with the U.S. Fish and Wildlife Service under the procedures of the Endangered Species Act. In addition, these Forest Service decisions are commonly subject to the Forest Service Administrative Review (“Appeal”) regulations 36 CFR 217.

## **Implementation of Alternative E**

If Alternative E is selected in the Record of Decision for this environmental impact statement, it will be implemented on lands administered by the Forest Service within the range of the northern spotted owl.

### **In Oregon and Washington**

On National Forests with lands within the spotted owl's range in Oregon and Washington, the Forest Plans will be amended by the Record of Decision for this environmental impact statement with the standards and guidelines presented in the selected alternative. The annual quantity of timber offered for sale will reflect the standards and guidelines and the areas designated by the selected alternative.

Projects will be conducted under the standards and guidelines of the selected alternative. Standards and guidelines and management direction in Forest Plans not directly superseded by the selected alternative will remain in effect. The Spotted Owl Habitat Areas (SOHAs) of Forest Plans, if not subject to management under Multiple-Pair Area standards and guidelines, will revert to management under Connecting Habitat or Owl Management Zone prescriptions, if applicable, or to Forest Plan direction (normally that of the surrounding management area) until the Forest Plan is amended. Special situations will be reviewed by the Research Committee before development activities are undertaken.

Implementation of revised management direction for northern spotted owl habitat may have effects on other goals and objectives in the Forest Plans that can not be evaluated at this time. The National Forests will monitor the effects of the standards and guidelines and the designation of areas for northern spotted owl habitat on environmental conditions, outputs, and services to identify further adjustments that may need to be considered in subsequent Forest Plan amendments or revisions.

The U.S. Fish and Wildlife Service is expected to issue a Recovery Plan for the northern spotted owl by mid-1992. When Forest Service objectives under the Recovery Plan have been identified, each affected National Forest will be directed to reevaluate the effect of management direction for northern spotted owl habitat on Forest-level programs and evaluate the need to amend or to revise its Forest Plan.

Revised management direction for northern spotted owl habitat will be incorporated into the Forest Plans immediately to guide project-level

## *The Alternatives*

planning. This direction will be in place until a long-term strategy for management of the spotted owl habitat is adopted following the Recovery Plan. At that time, the effects of management requirements for spotted owl habitat on the long-term relationship between levels of multiple-use goods and services provided by each affected National Forest can be evaluated and action taken to further amend or to revise the Forest Plans as appropriate.

### **In California**

On National Forests with lands within the spotted owl's range in California, until Forest Plans are completed, the standards and guidelines for this alternative would apply directly to projects in the Multiple-Pair Areas in this alternative, and in the Owl Management Zone.

The standards and guidelines and the areas designated in the alternative will be incorporated into the Forest Plans being developed. Until the Forest Plans are completed, the annual quantity of timber offered for sale will reflect the harvest implications of the standards and guidelines and the designated areas of the alternative selected.

For those National Forests administering lands within the range of the northern spotted owl with approved Forest Plans, management direction will be adjusted as directed in the preceding section "In Oregon and Washington".

### **Critical Habitat**

Critical Habitat will be managed as indicated in the section "Critical Habitat" at the beginning of this chapter.

## Comparison of the Alternatives

---

This section of Chapter 2 compares the important environmental impacts of the alternatives on forest resources. The analysis and the sources of data are discussed in detail in Chapter 3&4, and in Appendix B, Analytical Models.

### Spotted Owl Viability

#### Criteria

Viability ratings were assessed for each of the five alternatives using seven criteria. The ratings definitions range from HIGH (H) to LOW (L). A HIGH rating denotes a high likelihood of viability of the subspecies; a MEDIUM rating denotes an uncertain likelihood of viability; and a LOW rating denotes a low likelihood of viability. In summary, the criteria address:

1. **Potential Change** - current and predicted amount of owl habitat and potential rate of change in habitat.
2. **Distribution** - how nesting, roosting, and foraging habitat is distributed throughout the range of the northern spotted owl.
3. **Habitat Capability** - current and future habitat capability, estimated as potential pairs of northern spotted owls.
4. **Dispersal Habitat** - habitat for spotted owl movement or dispersal.
5. **Spacing** - spacing between designated areas.
6. **Patch Size** - size and distribution of spotted owl habitat patches within designated areas.
7. **Clustering** - the number and size of areas large enough to support multiple pairs of spotted owls.

#### Viability Rating for the Alternatives

The alternatives were assigned a viability rating based on the criteria used to assess population viability. The viability ratings were established by a panel of spotted owl scientists and biologists. The overall rating for each alternative combined quantitative analyses with

the panel's collective professional judgment and specific scientific knowledge of spotted owl population dynamics and habitat conditions.

The viability ratings are based on the assumptions that Forest Plans will be implemented as specified, and that other Federal land managers will manage forests in accordance with Section 7(a) of the Endangered Species Act. If these conditions change in the future, the effect on the viability of the northern spotted owl will be reevaluated.

The viability criteria evaluated how well each alternative provides for adequate numbers and distribution over space and time, to ensure viable populations of northern spotted owls well distributed throughout National Forests within the range of the owls. With respect to the viability of the northern spotted owl, short term refers to approximately the next 50 years; long term refers to a century or longer.

#### **Summary of Viability Ratings:**

Alternative A - LOW likelihood of population viability  
Alternative B - HIGH likelihood of population viability  
Alternative C - HIGH likelihood of population viability  
Alternative D - HIGH likelihood of population viability  
Alternative E - LOW likelihood of population viability

The above viability ratings assume other Federal Agencies will manage their land with a level of owl protection similar to the ISC Strategy, through consultation with the U.S. Fish and Wildlife Service under Section 7(a) of the Endangered Species Act. Participation by the Bureau of Land Management is necessary to provide for high population viability under Alternatives B, C, and D. Bureau of Land Management lands are particularly important to populations in the Oregon Coast Range and interchange of owls between the Klamath and Oregon Cascades Provinces. National Park lands are particularly important to viability of owls on the Olympic Peninsula.

#### **Alternative A**

Alternative A would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would not ensure a well-distributed population.

**Numbers.** Under Alternative A, spotted owl population numbers would likely decline at significantly high rates even in the short term. Habitat capability at year 150 indicates population sizes may be too small to ensure viable populations of spotted owls; habitat capability at year 150 is expected to be 30 percent of current capability estimates. Alternative A has no provision for conserving relatively large clusters of pairs (20 or more pairs).

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative A would also cause a low likelihood of population persistence over time. At the scale of pair home ranges, habitat would be designated in small, discontinuous patches. Alternative A would also cause increases in fragmentation of habitat, which in turn would likely degrade habitat quality. Alternative A does not provide for movement or dispersal habitat. Other problems with ensuring short- and long-term distribution of spotted owl habitat under Alternative A include no specific provision for improving current distribution problems in areas of concern, and very limited provision for mitigating for catastrophic loss of habitat. All of these conditions would likely not provide for well distributed populations over time.

Alternative A was also rated as providing a low likelihood of persistence of spotted owl populations in a report by the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991). The Interagency Scientific Committee also stated that the strategy would result in significant risk to the long-term persistence of the subspecies (Thomas et al. 1990: 384).

## **Alternative B**

Alternative B would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure well distributed viable populations over the long term.

**Numbers.** Spotted owl habitat capability would be provided at substantially higher levels than under Alternative A. Over the long term, Alternative B would provide for an increasing habitat base. Habitat capability is expected to be 74 percent of current capability estimates.

Alternative B also provides for relatively large (20-pair) clusters of spotted owl pairs, and provides for designation of a substantial area of young forests to become nesting, roosting, and foraging spotted owl habitat over time for additional pairs. This would enhance the connectivity of Habitat Conservation Areas over the long term, as well as provide for additional sources of reproductive pairs.

**Distribution.** Movement and dispersal habitat is specifically designated under Alternative B. This is a major provision that substantially enhances the occupancy rates of spotted owls within Habitat Conservation Areas by allowing for recolonization among pair clusters.

Clusters of pairs are to be provided in large sizes generally adequate to withstand some catastrophic losses of habitat due to fire, wind, etc.

## *The Alternatives*

These factors are critical to ensuring long-term persistence of spotted owl pairs within Habitat Conservation Areas and populations.

There are still short-term concerns for persistence of spotted owl populations in the Oregon Coast Range and Olympic Peninsula because these populations are small and at least partially isolated from other populations, and because habitats are highly fragmented. Alternative B addresses these areas of concern and provides for increased conservation of nesting, roosting, and foraging habitat therein.

The Interagency Scientific Committee (Thomas et al. 1990) concluded that full implementation of the ISC Strategy would provide for a high likelihood of population persistence over the next century throughout the current range of the northern spotted owl. Further, in their report the Scientific Panel on Late-Successional Forest Ecosystems also concluded that the ISC Strategy would provide for a high likelihood of persistence of the subspecies (Johnson et al. 1991).

On December 18, 1991, the U.S. Fish and Wildlife Service issued their biological opinion on the Draft Environmental Impact Statement and stated, “It is the biological opinion of the Service that adoption of the preferred alternative B, the Interagency Scientific Committee’s *A Conservation Strategy for the Northern Spotted Owl* (Conservation Strategy) [Thomas et al. 1990] is not likely to jeopardize the continued existence of the northern spotted owl.”

## **Alternative C**

Alternative C would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** Alternative C provides for an increasing habitat base over the long term. Habitat capability at year 150 is expected to be 92 percent of current capability estimates. Future habitat capability estimates for the Olympic Peninsula and Oregon Coast Range Physiographic Provinces are higher for Alternative C than for any of the other alternatives, except Alternative D.

Alternative C also provides for larger designated areas managed primarily for spotted owl habitat, and thus for larger clusters of pairs, than under Alternative A or B. This would provide for a higher persistence of pair clusters and a higher likelihood of reoccupancy of vacant habitats.

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative C would provide for more suitable habitat in larger and more contiguous blocks than under Alternative A or B. These

conditions would result in a higher likelihood of maintaining well distributed populations over time.

Additionally, Alternative C specifically provides for movement and dispersal habitat among designated areas managed primarily for spotted owl habitat. Overall, Alternative C would likely result in well distributed populations over time.

### **Alternative D**

Alternative D would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** Spotted owl population numbers provided under Alternative D are incrementally greater than those under Alternative B. Habitat capability at year 150 is expected to increase 40 percent over current capability estimates. Yet, over the long term, Alternative C would provide for a greater amount of young forests to grow into nesting, roosting, and foraging habitat conditions than under Alternative D.

**Distribution.** Alternative D would designate large contiguous habitat areas, and in addition, substantial amounts of nesting, roosting, and foraging habitat between designated areas. Alternative D also provides for specific conservation and restoration of habitat in areas of concern. The size of habitats designated under Alternative D also would be adequate to withstand some catastrophic losses of forests.

For all these reasons, Alternative D provides for population viability incrementally better than does Alternative B. Overall, Alternative D fares better for viability than does Alternative C; however, in the Olympic Peninsula and Oregon Coast Range effects on viability are similar for the two alternatives.

### **Alternative E**

Alternative E would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would not ensure a well distributed viable population.

Alternative E does not provide for some conditions key to ensuring population persistence in well distributed patterns.

**Numbers.** Spotted owl population numbers provided under Alternative E are expected to decline in the short and the long term. Habitat capability at year 150 is expected to be 43 percent of current capability estimates.

## *The Alternatives*

Alternative E provides for fewer and smaller clusters of spotted owls than Alternative B, C, or D. Many clusters are smaller than the size described in the scientific literature as necessary for long-term persistence.

**Distribution.** Alternative E prescribes specific management for spotted owl habitat within the Owl Management Zone. This zone does not include all National Forests within the range of the northern spotted owl specifically the Olympic and the north portion of the Siuslaw National Forests. Thus, in the long term it is likely that the range of the owl would be significantly reduced. Alternative E does provide for dispersal habitat between designated areas, but only for the portion of the range of the northern spotted owl within the Owl Management Zone.

Under Alternative E, there is limited latitude for loss of habitat due to catastrophic events because of the narrowness of the band of designated areas managed primarily for spotted owl habitat in the Washington and Oregon Cascades.

For these reasons, especially the problems with limited distribution and small cluster sizes, Alternative E provides for a LOW likelihood of providing viability of northern spotted owl populations well distributed throughout the planning area over time.

## Environmental Consequences to Forest Ecosystems

Alternatives A, E, B, C, and D designate increasing amounts of designated areas managed primarily for spotted owl habitat, respectively. The designated areas affect various resources differently.

Listed below is a summary of resource effects which are described more completely in Chapter 3&4, and in the appendices in Volume 2. Although these effects are examined in this document for consideration in the selection of a preferred alternative, it is not possible within the scope of this analysis to meet the absolute needs of, or remove every negative effect on, each of the following resources.

**Old Growth.** Old-growth forests are valued for their ecological diversity, scientific values, wildlife habitat, and recreational and scenic qualities, as well as for their potential contribution toward meeting timber production goals. There is much debate over both the definition of old-growth forests and the estimates of how much exist. Forest Service inventories indicate approximately 5.41 million acres of old-growth forest exist on the 17 National Forests included in this analysis. The amount of old-growth forest remaining after 50 years would vary from 3.67 million acres to 4.51 million acres across the alternatives.

**Insects and Diseases.** The level of insects and diseases will generally increase in designated areas managed primarily for spotted owl habitat in the dryer parts of the spotted owl's range because of a shift toward less insect and disease resistant tree species, lack of tree stocking control, and/or a failure to remove infected trees. This will likely reduce stocking levels and reduce some desirable structural components of the stand such as large trees (which will turn into large snags) and increase the hazard for catastrophic fires. The impacts from insects and diseases will be much greater within the east side mixed-conifer forest ecosystems and in the absence of preventative measures, habitat will be degraded.

**Port-Orford-cedar.** This is a highly valued tree species with limited distribution in southwest Oregon and northwest California. Many Port-Orford-cedar stands are currently being killed by an introduced root disease. Maintenance of this species has become a major concern and an action plan for Port-Orford-cedar (USDA Forest Service, unpublished) is being implemented by the BLM and the National Forests in Oregon and northern California. Designation of areas managed primarily for spotted owl habitat could limit timely removal of infected trees before spores can spread. However, uninfected drainages could benefit from such designation.

**Pacific Yew.** This tree is the principle source for taxol, a promising anti-cancer agent, which makes it an important commercial tree species. There is concern over harvesting Pacific yew because it does not regenerate freely in many management regimes. Pacific yew is commonly found in old-growth stands. The increased areas managed

primarily for spotted owl habitat in Alternatives A, E, B, C, and D, respectively, would provide more habitat for the species, but may reduce its availability for medicinal use.

**Threatened, Endangered, and Proposed Species.** The species of threatened, endangered and proposed plants and wildlife that may be affected by management of spotted owl habitat are generally favored by the alternatives that provide the greatest amount and distribution of designated areas managed primarily for spotted owl habitat. In general, the alternatives with the most designated area incur the least amount of risk to threatened, endangered and proposed species due to habitat modification and human-caused disturbances.

**Wildlife Species.** Those wildlife species that are closely associated with old-growth or late-successional forests also benefit more from alternatives designating more spotted owl habitat.

Wildlife species that use early-successional forests may currently have greater amounts of habitat created by clearcut harvest in the last several decades available to them than was historically available due to natural processes such as wildfire. The trend of increasing harvest-created early-successional forest habitat will reverse in areas designated primarily for spotted owl habitat. Species using early-successional forests and edge habitats may benefit more from alternatives that provide fewer and smaller designated areas managed primarily for spotted owl habitat.

**Watershed, Fisheries, and Soils.** These resources are generally protected in all alternatives by existing best management practices, standards and guidelines, and mitigation measures. High rainfall events and other factors point to some negative effects from timber harvests on these resources. In general, the alternatives with the most designated areas managed primarily for spotted owl habitat incur the least amount of risk on water quality, fisheries, and soils due to decreased sedimentation and more stable water temperatures.

**Fuels Management.** Fuels management activities are generally associated with vegetation management projects like timber sales, partly because much of this work is funded directly from timber sale receipts. If funding for fuels management in or around designated areas is not available from some other source, the risk of catastrophic fires is likely to increase.

**Mineral Resources.** These resources could be affected as some geothermal, oil, and/or gas development opportunities are foregone within designated areas managed primarily for spotted owl habitat. At the same time, mining of locatable minerals, which is permissible if the areas are not withdrawn from mineral entry, may necessitate tree removal and thus affect some habitat within the designated areas.

**Recreation.** The trends in recreational opportunities on the National Forests will be little affected by Alternative A or E. The trend towards greater acreage for road-based opportunities will progressively slow or reverse in Alternatives B, C, and D, and provide a more stable or slightly increasing land base for primitive and non-motorized recreation. Ski area development or expansion will be constrained in Alternatives C and D, and some will be constrained in Alternative B. The trend toward management for visual quality on the National Forests will slow or reverse with Alternatives B, C, and D, with progressively fewer viewsheds showing signs of roads and timber harvest.

**Cultural Resources.** Cultural resources will be less disturbed in alternatives that designate greater areas managed primarily for spotted owl habitat, but where features are naturally deteriorating, these resources will also be less likely discovered through pre-project surveys.

**American Indian Religious Sites.** American Indian religious sites incur the least amount of risk in alternatives with the most designated area managed primarily for spotted owl habitat.

**Transportation Systems.** There will be less road building under alternatives designating more areas for spotted owl habitat, with corresponding differences in effects on forest resources and activities. On portions of designated areas where roads already exist, some roads will be closed because of reduced need and funding.

## **Timber Management on the National Forests**

On National Forests in Washington, Oregon, and northern California within the range of the northern spotted owl there are approximately 12,298,000 acres of land considered technically suitable (potentially suitable) for timber production (Table 2-1). Under Alternatives A (SOHAs), B, C, D, and E designated areas managed primarily for owl habitat preclude timber production on 4 percent, 23 percent, 27 percent, 38 percent, and 8 percent of these lands, respectively. Final or Draft Land and Resource Management Plans designate an additional 22 percent, or 2,650,000 acres, of technically suitable lands to be managed for resource values such as stream protection, scenic corridors, etc. The remaining areas would be considered suitable for timber production.

*The Alternatives*

**Table 2 – 1 Acres Suitable for Timber Production, by Alternative**

Acres technically suitable for timber production	Acres selected as suitable for timber production				
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
12,298,000	9,150,200	6,747,900	6,275,000	4,951,900	8,548,500
% of tech. suit:	74%	55%	51%	40%	70%

Partly because forest stands designated to be managed primarily for spotted owl habitat tend to be older, higher volume stands, there is not a linear relationship between the number of acres designated for spotted owl habitat, and reduction in allowable sale quantity (ASQ). The effect of decreasing amounts of suitable timber acreage in Alternatives A, E, B, C, and D, respectively, is a substantial decrease in ASQ.

**Table 2 – 2 Average Annual Allowable Sale Quantity (ASQ)**  
Average annual allowable sale quantity and percent change from Alternative A. (million board feet)

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Washington	752	328 (-56%)	279 (-63%)	150 (-80%)	564 (-25%)
Oregon	1846	1214 (-34%)	982 (-47%)	470 (-75%)	1449 (-22%)
California	600	281 (-53%)	264 (-56%)	189 (-69%)	444 (-26%)
Total	3198	1823 (-43%)	1525 (-52%)	809 (-75%)	2457 (-23%)

Standards and guidelines preclude scheduled timber harvest within designated areas managed primarily for spotted owl habitat in all alternatives except Research MPAs in Alternative E. Research MPAs permit some harvesting for research purposes.

For Alternatives B, C, D, and E, forest lands between designated areas managed primarily for owl habitat are generally managed for dispersal habitat. Standards and guidelines for Alternatives B, C, and D require dispersal habitat to be managed to achieve or maintain at least 50 percent of the area having 40 percent canopy closure or greater in trees 11 inches or more d.b.h. This requirement accounts for 300 million board feet of the ASQ reduction in Alternatives B and C when compared with Alternative A. Alternative E has a similar dispersal habitat constraint but the effect is closer to 250 million board feet reduction when compared to Alternative A because the Alternative E constraint does not apply to all forest lands.

Under current Forest Plan land allocations, there are few opportunities to mitigate the reduction in ASQ through more intensive management.

Forest Plans already schedule most economically viable and practical stand treatments that affect ASQ.

## **Economic and Community Consequences**

There are five primary criteria which can be used to provide a comparison of the economic and community effects of the alternatives. These five criteria are employment, income, revenues, payments to counties, and timber market effects.

### **Employment and Income**

National Forest timber harvests in Washington, Oregon, and Northern California are an important source of employment and income. Over the past 5 years, timber harvests from the 17 National Forests included in this analysis have created an average annual employment level of 71,100 jobs with an associated income of \$3.2 billion. Alternative A would provide the highest future employment and income. This alternative would generate employment of 48,000 jobs annually with an income of \$2.2 billion. Alternative B would reduce employment from Alternative A by 20,700 jobs per year (43 percent) and related income by \$486 million (46 percent). Alternative C would have further reductions in employment and income, lowering employment and income 52 percent. The lowest employment and income would occur under Alternative D. It would generate 12,400 jobs and an income of \$543.4 million. This is a reduction from Alternative A of 74 percent. Alternative E would reduce employment from Alternative A by 10,900 jobs (23 percent) and related income by \$427.9 million (23 percent).

Timber harvests from National Forests generate revenues which are returned to the Federal Treasury. Alternative A would provide the highest revenue levels in the future. It would generate revenues of \$940 million annually by 1995. Alternative B would reduce these revenues by \$275 million or 29 percent. Alternative C would reduce revenue levels by 46 percent annually by 1995. Alternative D would return the least amount of money to the Federal Treasury, generating revenues of \$351 million from timber sales. This is 63 percent less than Alternative A. Alternative E would reduce revenues by \$175 million (19 percent) from Alternative A.

### **Payments to Counties**

Under current law, 25 percent of the revenues collected by each National Forest are returned to the local counties within that National Forest. These funds can be used for roads or schools, and represent an important source of income for many counties. Alternative A would provide approximately \$235 million in annual payments to counties. Alternative D would provide the lowest returns, amounting to \$88

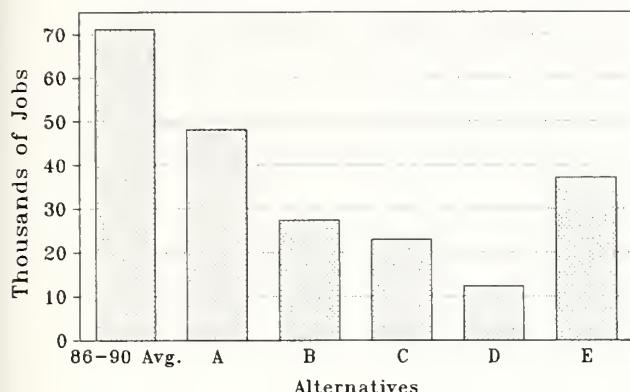
## *The Alternatives*

million. Alternatives E, B and C would provide \$191 million, \$166 million, and \$127 million respectively in payments to counties.

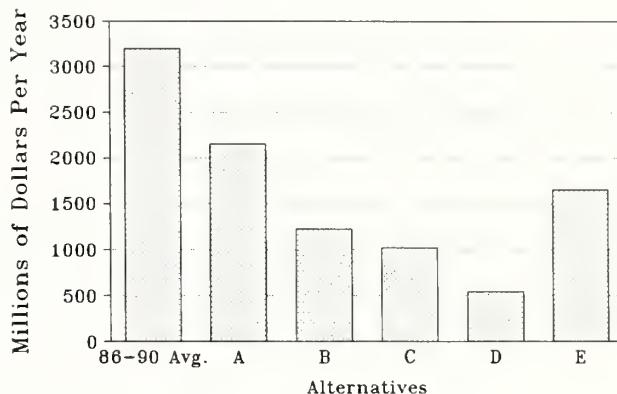
The changes in National Forest timber harvest associated with the alternatives would affect national and regional timber markets. As Alternatives E, B, C, and D progressively reduce National Forest timber harvests, prices of wood products would increase. These higher prices would stimulate increased production from private lands and other regions in the United States. The higher prices would also lead to an increase in imports of wood products from other countries, primarily Canada.

## Comparison of the Alternatives

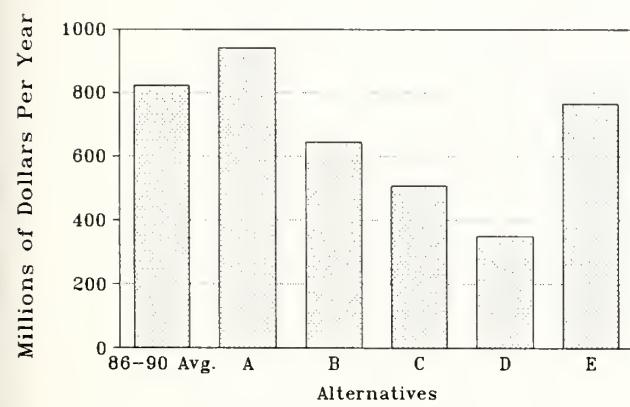
**Figure 2 - 1**  
**Historic and Projected Employment**  
 National Forest employment effects including  
 5 year average and projected for 1995  
 by alternative



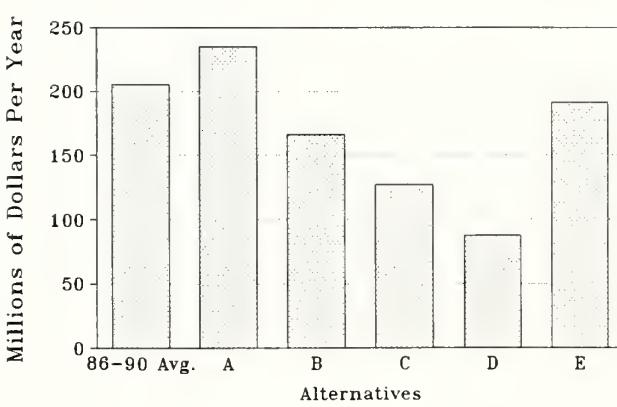
**Figure 2 - 2**  
**Historic and Projected Income**  
 National Forest income effects including  
 5 year average and projected for 1995,  
 by alternative



**Figure 2 - 3**  
**Historic and Projected Revenues**  
 National Forest revenues effects including  
 5 year average and projected for 1995,  
 by alternative



**Figure 2 - 4**  
**Historic and Projected Payments**  
 National Forest payments to counties effects  
 including 5 year average and projected for  
 1995, by alternative



## **Social and Community Consequences**

Changes in the management of the National Forests affect people and the families, groups, and communities to which they belong. The social, community, and cultural changes resulting from the alternatives will be felt almost exclusively in western and central Washington and Oregon, and the northwest quadrant of California. The social effects are primarily those which flow directly and indirectly from economic changes in wood products and forestry employment. These effects will be disproportionately intense in rural and timber-dependent areas.

Effects on individuals from job loss include: depression, spouse and child abuse, alcohol and drug abuse, social conflict and stress-induced illness. With this combination of factors, many people are likely to suffer both a loss of self-esteem and a reduced ability to make sound decisions about retraining, moving, or new jobs.

Reductions in payments to counties (see previous discussion in this section) will occur at a time when county governments are pressed to provide help for citizens stressed by downturns in employment. Cutbacks in community services tend to erode essential community institutions and the spirit of a community. These services are vital for helping communities make a transition from heavy reliance on timber to a more diversified economy.

The social effects of the alternatives stem fairly directly from changes in the timber harvest levels of the alternatives.

With Alternative A, timber-dependent communities and local governments will face the social effects of future average timber harvest levels as low as those experienced only twice in the last 10 years. The social effects of Alternatives B, C, and D will focus around the implications of community-wide job loss, and the related effects of changes in the management of the National Forests. While it is not possible to quantify the degree of those community effects, they will intensify to an extent comparable to the reduction in timber harvest. Where Alternative B represents a 43 percent reduction from the levels of Alternative A, Alternative C is a 52 percent reduction, and Alternative D is a 75 percent reduction. As timber harvest declines, the social effects will be similar but even more intense and debilitating to timber-dependent communities.

The loss of business vitality in rural towns from reductions in timber and other forest development activities compounds the difficulty in providing services, skilled work force, and the quality of life and appearance that will attract new industries and recreational visitors.

The social effects of Alternative E in the aggregate are between those of Alternative A and B; Alternative E represents a 23 percent reduction

from the levels of Alternative A. The impacts will be very noticeable in some communities, and not experienced in others.

Timber-dependent communities and the wood products industry have experienced many changes. Changes resulting from business cycles, automation, and planned reductions in timber harvest have been met and adapted to with some success. The changes that would occur in implementing Alternative B, C, or D are different from the changes that these communities experienced in the past or foresaw for the near future.

There is a difference in the permanence of the changes. A market downturn in 1982 forced reductions in timber harvest in National Forests in Washington, Oregon, and California to levels roughly similar to those of Alternative C. Those changes were seen as, and were, temporary. Most communities, individuals, and families were able to cope successfully. The changes in timber harvest from Alternative B, C, or D will last longer than any firm or worker's ability to "wait it out". The changes in timber harvest under Alternative E would have less impact than under Alternative B, but would still result in a downturn from future harvest levels under Alternative A.

There is a difference in the amount of change. Alternative D would force harvest levels lower than experienced in Washington, Oregon, and California in the last two decades.

There is a difference in the source of the change. People in the wood products industry have a strong commitment to the workings of the marketplace—the source of previous changes. Changes stemming from these alternatives are a result of the interpretation of laws and regulations, and the findings of scientists.

There is a difference in the attitude of the rest of society. There is a perception that there is little support for the plight of people in the industry and in timber-dependent communities.

For these reasons, changes to timber-dependent communities and their people from the implementation of Alternative B, C, or D are different from previous changes they have experienced and weathered. These communities—loggers, mill owners and workers, and small businesses—and their families will experience significant, long-lasting, impacts that will be difficult to overcome.



## Alternatives Eliminated from Detailed Study

---

The interdisciplinary team considered several alternatives but eliminated them from the detailed study that Alternatives A, B, C, D, and E received. The reasons for eliminating them from detailed study are presented here.

### Old-Growth Forests and Associated Wildlife Species

Alternatives presenting an old-growth forest management plan, or focusing on the management of other old-growth associated wildlife species, were not studied in detail. All old growth is not spotted owl habitat; all spotted owl habitat is not old growth. While an alternative that would provide management direction for old-growth forests and wildlife species would provide management direction for habitat for the spotted owl, it would impose greater change on Forest management and the economy than necessary to meet the underlying purpose and need of the proposed action (see Chapter 1). The Council on Environmental Quality Regulations (40 CFR 1502.13) directs agencies to propose alternatives to respond to the underlying purpose and need.

The Regional Guides, the approved Forest Plans, and those Forest Plans still in preparation all address the issue of old-growth management. This environmental impact statement has a focused, and different, proposed action and a limited time for preparation.

The adoption of any of the alternatives studied in detail will have an effect on the amount and distribution of old-growth forests, and on the wildlife and plant species found there. Although an alternative focusing on management for old-growth forests and associated wildlife species is not studied in detail in this environmental impact statement, the consequences of all the alternatives on old-growth forests and wildlife were studied and are displayed in Chapter 3&4.

### Siskiyou County Proposals

In response to the request for information during scoping, the interdisciplinary team received a letter from the Siskiyou County (California) Board of Education and Board of Supervisors dated June 6, 1991. In the letter, they urged that a separate environmental impact statement be prepared for management of spotted owl habitat in northern California owing to the different habitat requirements there.

The Forest Service believes that this environmental impact statement is the appropriate vehicle for amending both the Regional Guides.

The planning regulations (36 CFR 219) do not require separate environmental impact statements to amend more than one Regional Guide. The court ordered the Forest Service “to develop quickly a *plan* to ensure the viability of the spotted owl on the national forests” (emphasis added) (*SAS v. Evans*, 1991). The Council on Environmental Quality regulations recommend, “Using program, policy, or plan environmental impact statements and tiering from statements of broad scope to those of narrower scope, to eliminate repetitive discussions of the same issues” (40 CFR 1500.4(i)). The NFMA regulations require the agency to maintain the viability of the species throughout the planning area. This one environmental impact statement one management plan assures a range-wide analysis and provides for the appropriate contiguity of habitat and management throughout the range.

In their “Questions and Answers,” the Interagency Scientific Committee acknowledged the different habitat needs of the spotted owl in northern California (Thomas 1991, 38, 44-45). The Conservation Strategy’s standards and guidelines for northern California call for practices that are more restrictive than practices on private forest lands where spotted owls are found.

In northern California, the National Forests typically are higher in elevation and have different rainfall, soils, tree species, and silvicultural histories and regimes than forests on private land. Because of these different environmental and silvicultural conditions, similar management to private land would pose a higher risk to the viability of the spotted owl were it applied to the National Forests there.

The interdisciplinary team has examined the research and field reports regarding the occurrence and habitat of spotted owls in northern California. The evidence at this time is that the ISC’s Strategy for the northern California National Forests is appropriate to meet the underlying purpose of the proposed action: “to ensure the northern spotted owl’s viability.” Thus, a modification of the ISC Strategy for northern California was not developed into an alternative studied in detail.

The ISC Conservation Strategy encourages research to test alternate management practices, as well as their adoption, when validated. Alternatives A through E include the opportunity to adjust management direction in the future based on monitoring and new information.

## Northwest Forestry Association Alternatives

On August 1, 1991, the interdisciplinary team received outlines of two alternatives under development by the Northwest Forestry Association. The first proposal was to redraw the Habitat Conservation Area (HCA) maps rigorously applying the formula of 75 percent of the median

home range acreage, and placing HCAs at the maximum separation mileage as presented in Appendices I and P of the ISC Report (Thomas et al. 1990). The second proposal was to redraw the resultant HCA boundaries so that they would contain no more than 20 pairs of owls.

These outlined proposals were received too late to incorporate into the Draft Environmental Impact Statement. The time needed to develop in detail, map, and analyze effects for the Draft would have resulted in a substantial departure from the timeline needed to meet the court-ordered timeline. The text of the Draft Environmental Impact Statement indicated that the interdisciplinary team would consider a proposal of this type for the Final Environmental Impact Statement. Alternative E incorporates major elements of those approaches.

During the time between the Draft and Final Environmental Impact Statements the interdisciplinary team considered the two approaches suggested by the Northwest Forestry Association. Those biologists who had mapped the ISC Conservation Strategy advised that the reason the size and spacing of mapped HCAs did not conform to the minimum standards and guidelines in Appendix Q of the ISC Report was because modifications were made to incorporate several considerations. Some HCAs were larger because they were isolated from other areas, located in or near areas of concern, or contained high proportions of areas of non-habitat within the HCA. Spacing of HCAs was closer to take advantage of habitat in Wilderness and known concentrations of spotted owls. Spacing in some cases needed to be closer in order to map HCAs in areas of habitat on Federal lands.

This advice and evaluation indicated that an alternative based on the two proposals from the Northwest Forestry Association could not map the HCAs at the minimum criteria and still make full use of reserved lands. The strict application of the minimum criteria would result in significantly less land available for timber production than the Association expected. It would also protect fewer owls than the ISC Strategy. Because these alternatives would result in significantly less spotted owl protection and not much more timber harvesting, they were not seen as reasonable alternatives to the proposed action and were eliminated from detailed study.

## **Management of Owl Habitat on Other Ownerships**

The underlying purposes of the proposed action is to satisfy the court order and amend Forest Service direction. The alternatives studied in detail in this environmental impact statement apply only to National Forests. Alternatives which would direct management on state, private, tribal, or other Federal land were eliminated from detailed study.

The Forest Service has no authority to prescribe management on lands owned by individuals or private corporations, nor on lands managed

### *The Alternatives*

by other agencies, governments, or tribes. (The analysis in this environmental impact statement does consider the effect of management on other lands as part of the assessment of the long-term viability of the northern spotted owl. See “Current Management of Other Lands” and “Population Viability” in Chapter 3&4.)

**3&4**

---

**Chapter 3&4**

**Affected  
Environment  
and  
Environmental  
Consequences**

## Changes Between Draft and Final Chapter 3&4

Various sections of this chapter have been updated, clarified, or modified in response to comments from the public and internal review. The following are the principle changes.

- The environmental consequences of Alternative E are presented.
- The environmental consequences for Alternative C reflect the changes in the U.S. Fish and Wildlife Service's January 1992 final rule on Critical Habitat.
- The spotted owl viability analysis is based on the following additional quantitative information:

Criterion 1 - includes updated information on acres of nesting, roosting, and foraging habitat

Criterion 2 - includes data on areas of concern

Criterion 3 - estimates current and future habitat capability instead of using known spotted owl locations

Criterion 4 - remains the same as in the draft

Criterion 5 - reports actual distances between mapped designated areas

Criterion 6 - remains the same as in the draft

Criterion 7 - uses habitat capability to estimate cluster sizes instead of assessing standards and guidelines

- The assumptions for the viability analysis are clarified, including assumptions about management on lands outside National Forests.
- The employment multiplier reflects a more accurate accounting of jobs in, and dependent on, the timber industry.
- The data and spatial information used for analysis of spotted owl habitat, known owl locations, and lands suitable for timber production were updated, See Appendix B, Analytical Models

# Chapter 3&4

## The Affected Environment and Environmental Consequences

### Introduction

Chapter 3 (Affected Environment) and Chapter 4 (Environmental Consequences) have been combined in this document. Information about the conditions and trends of a resource will appear just before the environmental consequences of the alternatives on that resource. Most environmental impact statements place them in separate chapters.

This chapter presents information about those aspects of the environment that are affected by the management prescribed in the alternatives, with information about its condition, ongoing trends, and interrelationships with other parts of the environment. It also presents the direct, indirect and cumulative effects (or impacts) of management under the alternatives. These form the scientific and analytic basis for the Comparison of the Alternatives section in Chapter 2.

This chapter is organized into three main sections: The Northern Spotted Owl; The Forests, Their Management and Their Resources; and People and the Forests.

### Incomplete or Unavailable Information

There is less than complete knowledge about many of the relationships and conditions of spotted owls, forests, jobs, and communities. The ecology, inventory, and management of large forests is a complex and developing science. The biology of the spotted owl prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science.

## *The Affected Environment and Environmental Consequences*

The interdisciplinary team examined the data and relationships used to estimate the effects of the alternatives. There is a substantial amount of credible information about the topics of this environmental impact statement, and the basic data and the central relationships are well established.

When encountering a gap in information, the interdisciplinary team posed the question implicit in the Council on Environmental Quality (CEQ) Regulations on incomplete or unavailable information: Is this information “essential to a reasoned choice among alternatives”? (40 CFR 1502.22(a)). The interdisciplinary team concluded that the missing information would frequently add precision to estimates or better specify a relationship. However, the basic data and central relationships are sufficiently well established in the respective sciences that the new information is very unlikely to reverse or nullify understood relationships. Thus, new information would be welcome, and would add precision. However, it was not essential to a reasoned choice among the alternatives as they are constituted.

It is relevant to note also that each of the alternatives do incorporate an adjustment process that provides for modification of habitat management should new scientific information warrant a change in management. This adjustment process, which incorporates the monitoring plan of the alternative selected, provides additional assurance of compensating for catastrophic events.

## **Cumulative Impacts**

“Cumulative impacts” result from the incremental impact of individually minor but collectively significant impacts taking place over a period of time. Virtually all of the environmental consequences disclosed in this environmental impact statement are “cumulative impacts” as they are the environmental and management impacts of an accumulation of management actions which will happen locally throughout the range of the northern spotted owl. These management actions, collectively implementing the management plan, have the cumulative environmental impacts disclosed in this chapter.

## **Affected National Forests**

The standards and guidelines from this environmental impact statement apply to all lands administered by the Forest Service within the range of the northern spotted owl. The environmental consequences are analyzed for the 17 National Forests identified in tables and on maps. The analysis in this environmental impact statement does not incorporate the Lassen or the Modoc National Forests because only a small portion of these Forests is within the subspecies’ range.

# The Northern Spotted Owl

---

## Introduction

Several excellent reviews of current literature on the northern spotted owl (*Strix occidentalis caurina*) have been conducted in recent years. For a complete discussion of the habitat needs and life history of the northern spotted owl, see the "Report of the Advisory Panel on the Spotted Owl" (Dawson et al. 1986), "Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide" (USDA 1988b), The Interagency Scientific Committee's (ISC) "Conservation Strategy for the Northern Spotted Owl" (Thomas et al. 1990), the U.S. Fish and Wildlife Service's three status reviews (USDI 1987; USDI 1989; Anderson et al. 1990), and the June 26, 1990, final ruling that listed the northern spotted owl as a Threatened subspecies (Federal Register. 55: 26114).

The ISC Report is considered to be a scientifically credible conservation strategy for the northern spotted owl. Much of the discussion on northern spotted owl habitat and biology presented here is a summary of information that is covered more thoroughly in the ISC Report. However, additional studies on the northern spotted owl have been completed since the ISC Report was published or are currently in progress. Draft and final papers of these recent studies were examined to obtain the most up-to-date information on spotted owl habitat and biology. A list of the literature reviewed and an abstract for final reports is included in Appendix D, Annotated Bibliography.

Research on the northern spotted owl is ongoing. The interdisciplinary team maintained communication with scientists specializing in the spotted owl throughout the development of this environmental impact statement. The best current data and knowledge were used to assess viability of the northern spotted owl. However, no new studies were conducted. Instead, the team relied on existing analyses of population viability and status.

New models are under development, most notably the spatially explicit population model of McKelvey (1991). However, this model has not received sufficient testing and review to warrant its use at this time to assess the alternatives presented in this environmental impact statement.

## General Northern Spotted Owl Biology

The northern spotted owl is a medium-sized owl with a round head, dark eyes, dark brown coloring with white spots on the head and neck, and white mottling on the abdomen and breast. The sexes are similar except that females average slightly larger in size and have higher-pitched calls than males. Spotted owls forage mostly at night, eating primarily small mammals such as flying squirrels (*Glaucomys sabrinus*), mice (*Peromyscus* spp.), woodrats (*Neotoma* spp.), rabbits (*Sylvilagus* spp.), and hares (*Lepus* spp.). Remains of prey species other than mammals also appear in diet analyses, but in substantially lower numbers. During the day spotted owls roost in trees, usually close to the nest site (Thomas et al. 1990).

Paired individuals tend to behave territorially with other northern spotted owls, and seem to inhabit the same breeding grounds for several years as long as nesting, roosting, and foraging habitat is present. One to three eggs, usually two, are laid in March or April. The female incubates the eggs and broods the young nestlings while the male provides most of the food. After leaving the nest in May or June, the young fledglings are fed by both parents until August or September. By September or October, the young become independent and disperse from the natal area. These young spotted owls, if they survive, can disperse to suitable, uninhabited forest habitats and find a mate, settle as a territorial single, or become a “floater”. Floaters are nonbreeding adults and subadults that move and live within a breeding population, potentially replacing breeding adults that die.

Although a pair of spotted owls may occupy and defend a territory, they may not nest every year (Thomas et al. 1990). Variation in nesting attempts and nesting success is an important aspect of population dynamics. Some aspects of spotted owl biology are not well understood, such as annual variation in percent of spotted owls paired, percent of paired spotted owls that attempt breeding, percent of breeding spotted owls that produce young, egg mortality in the nest, nestling mortality, fledgling mortality, rates of successful dispersal by juveniles and the determining mechanisms of each of these rates. Each of these rates can affect population trends. Variations in these rates and other factors can influence likelihoods of persistence of the population over time.

The northern spotted owl is widely distributed in forested regions of western Washington and Oregon, northwestern California, and also occurs sparsely in southwestern British Columbia, Canada, primarily in mature and old-growth conifer forests. The American Ornithologists Union recognizes three subspecies of spotted owls: 1. northern spotted owl (*Strix occidentalis caurina*); 2. California spotted owl (*Strix occidentalis occidentalis*); and 3. Mexican Spotted owl (*Strix occidentalis lucida*). The American Ornithologists Union, the accepted authority in such matters, recently ruled that this classification will stand in spite of recent findings that raised questions about the validity of the three subspecies' status based on their genetic similarities. The

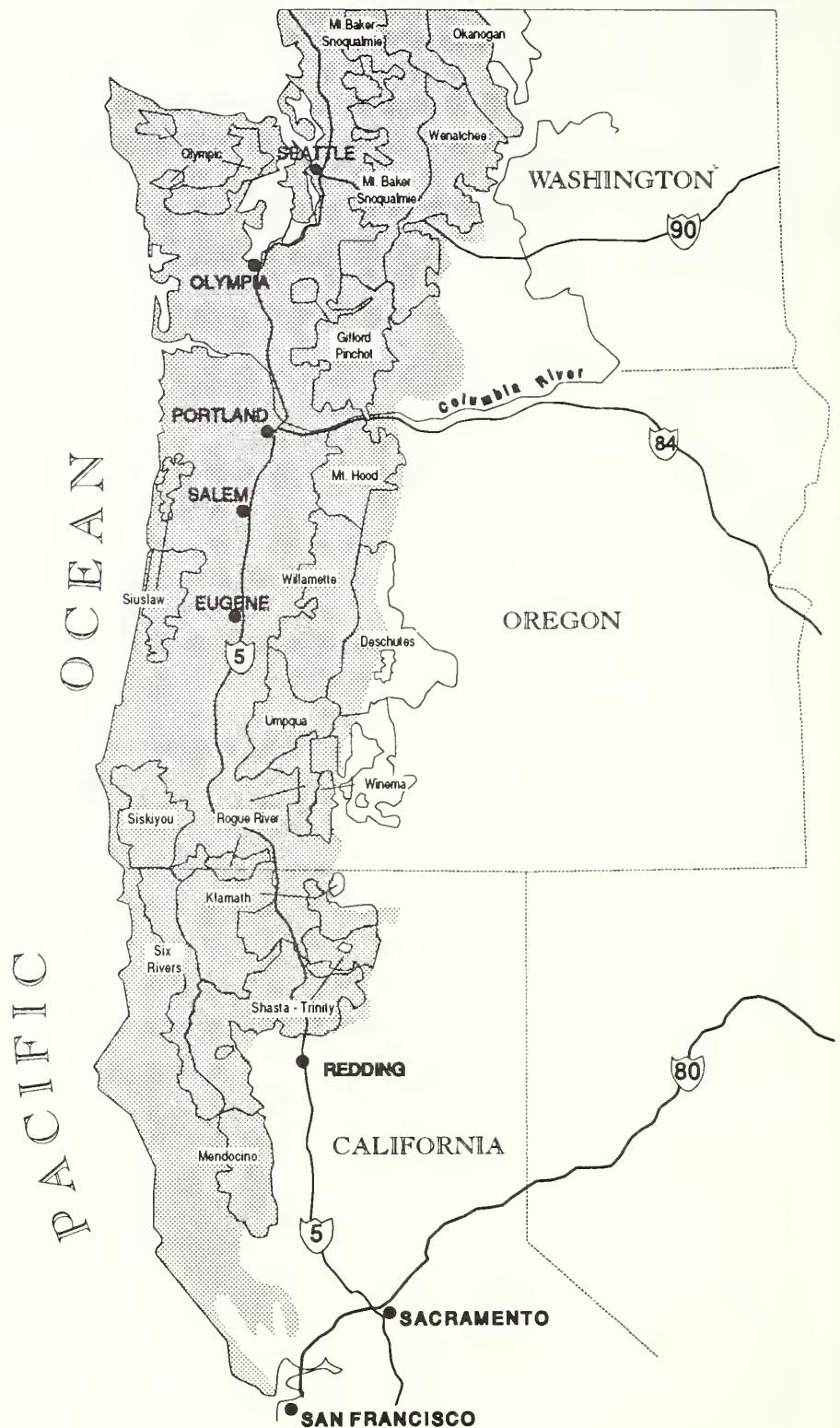
### *The Northern Spotted Owl*

ISC Report discussed the rationale behind the decision that follows a standard used in similar cases reviewed by the taxonomy committee of the American Ornithologists Union (Thomas et al. 1990). This document deals exclusively with the northern subspecies.

The decision as to whether or not the northern spotted owl is indeed a subspecies affects this document little. The planning regulations (36 CFR 219.19) for implementing Section 6 of NFMA require maintaining “viable populations of existing native and desirable non-native vertebrate species...well distributed in the planning area.” In this context, the California and Mexican spotted owl subspecies do not contribute to ensuring viability in the area covered by this environmental impact statement.

*The Affected Environment and Environmental Consequences*

**Figure 3&4 – 1**  
**Range of the**  
**Northern**  
**Spotted Owl**  
**Within the**  
**United States**



## Range of the Northern Spotted Owl

To provide a habitat management strategy responsive to the northern spotted owl population it is necessary to identify the range of the subspecies.

The ISC Report states: "The present range of the spotted owl approximates the limits of its historic range. The range encompasses an area from southwestern British Columbia south through the coastal mountains and Cascade Range (both west and east sides) of Washington and Oregon, south into southwestern Oregon and northwestern California north of San Francisco" (Thomas et al. 1990: 60).

The range of the northern spotted owl is shown in Figure 3&4 – 1 and includes the National Forests listed in Table 3&4 – 1. The range of the northern spotted owl was clarified and delineated in June 1991 by the interagency Technical Review Team for the northern spotted owl (Mays and Mulder 1991b). The range line may change as new data on the spotted owl is collected. As stated by the interagency Technical Review Team for the northern spotted owl:

"...This [range] line will be used by the federal and state agencies as they proceed in management of the northern spotted owl."

"It must be noted however, that as a federally listed species, northern spotted owls are under [protection] of the Endangered Species Act wherever they may be found."

"As further information is developed in the future, it will be evaluated and may result in modification of this line."

**Table 3&4 – 1 The Range of the Northern Spotted Owl**  
National Forests within the range of the northern spotted owl in the United States.

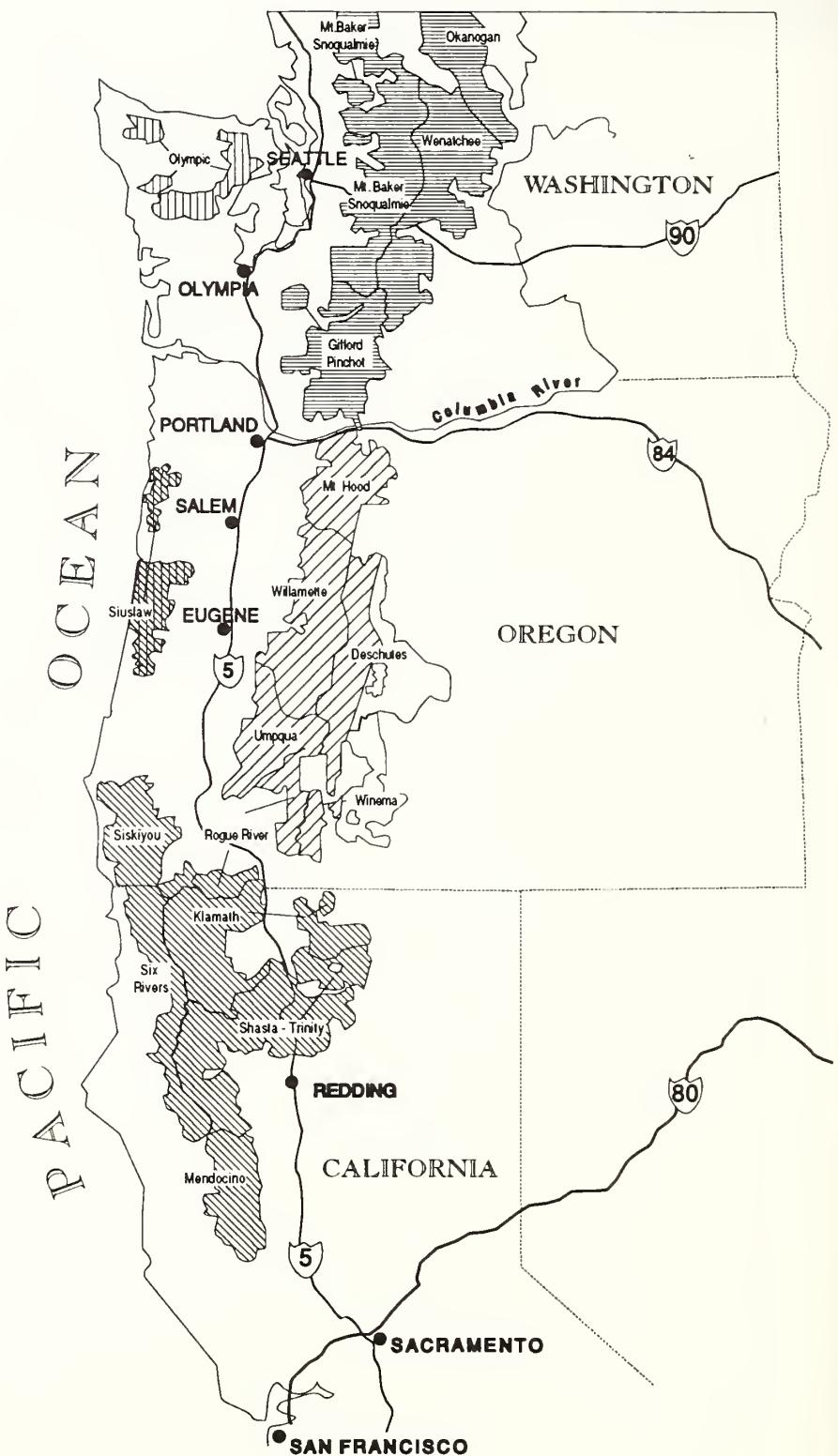
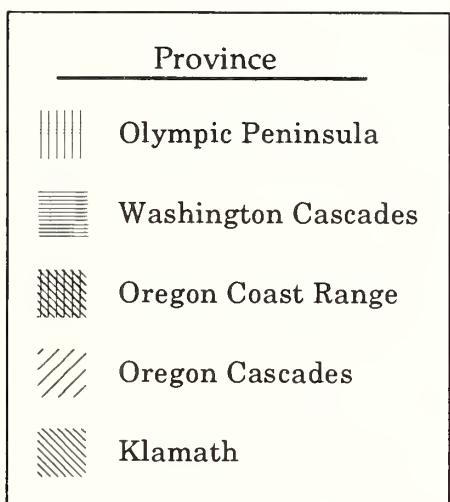
Washington	Oregon	California
Olympic	Siuslaw	Shasta-Trinity <sup>2</sup>
Mt. Baker-Snoqualmie	Mt. Hood	Klamath <sup>2</sup>
Gifford Pinchot	Willamette	Mendocino
Okanogan <sup>1</sup>	Umpqua	Six Rivers
Wenatchee <sup>2</sup>	Deschutes <sup>1</sup>	Modoc <sup>3</sup>
	Winema <sup>1</sup>	Lassen <sup>3</sup>
	Rogue River	
	Siskiyou	

<sup>1</sup>Significant portions are outside the range of the spotted owl.

<sup>2</sup>Small portions are outside of the range of the spotted owl.

<sup>3</sup>Only small areas are within the range of the spotted owl.

**Figure 3&4 – 2**  
**National**  
**Forests by**  
**Physiographic**  
**Province in**  
**the Range of**  
**the Northern**  
**Spotted Owl**



All of the National Forests listed in Table 3&4 – 1 that do not have footnotes, as well as the portions of National Forests included in footnotes 1 and 2 that are within the current delineation of the northern spotted owl range, were used for the population viability analysis in this document. The Modoc and Lassen are not included in the analysis in this document due to the limited number of acres involved. Management direction as a result of this environmental impact statement process will apply throughout the range of the northern spotted owl and to all those National Forests included within that range whether or not they were used for analysis purposes.

## **Physiographic Provinces**

The range of the northern spotted owl varies widely in climate and geology, resulting in varied forest zones. Studies show differences in spotted owl numbers, distribution, and habitat-use patterns between these regions or physiographic provinces (Thomas et al. 1990: 61; USDA 1988b). Dividing the range of the spotted owl into physiographic provinces better reflects variations in geography and habitat conditions for population viability analyses.

For the purpose of displaying information in this document, five physiographic provinces have been identified: Olympic Peninsula, Washington Cascades, Oregon Coast Range, Oregon Cascades, and Klamath. The National Forests included in each physiographic province are shown in Figure 3&4 – 2 and listed in Table 3&4 – 2.

**Table 3&4 – 2 National Forests by Physiographic Provinces**  
National Forests by physiographic provinces within the range of the northern spotted owl.

Olympic Peninsula Province	Oregon Cascades Province
Washington:	Oregon:
Olympic National Forest	Mt. Hood National Forest
Washington Cascades Province	Willamette National Forest
Washington:	Umpqua National Forest
Mt. Baker-Snoqualmie National Forest	Deschutes National Forest
Gifford Pinchot National Forest	Winema National Forest
Okanogan National Forest	Rogue River National Forest <sup>1</sup>
Wenatchee National Forest	
Coast Range Province	Klamath Province
Oregon:	Oregon:
Siuslaw National Forest	Rogue River National Forest <sup>1</sup>
	Siskiyou National Forest
	California:
	Shasta-Trinity National Forest
	Klamath National Forest
	Mendocino National Forest
	Six Rivers National Forest

<sup>1</sup>The portion of the Rogue River National Forest northeast of Interstate-5 is included in the Oregon Cascades Province and the portion southwest of Interstate-5 is included in the Klamath Province.

This page left blank for notes

## Habitat Definitions

---

### Northern Spotted Owl Nesting, and Roosting, and Foraging Habitat

The ISC Report defined suitable habitat as, “an area of forest vegetation with the age-class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the northern spotted owl” (Thomas et al. 1990: 423).

Spotted owls find suitable habitat in a variety of forest types including western hemlock (*Tsuga heterophylla*), white fir (*Abies concolor*), Pacific silver fir (*Abies amabilis*), Sitka spruce (*Picea sitchensis*), mixed-evergreen, mixed-conifer, redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), red fir (*Abies magnifica*), ponderosa pine (*Pinus ponderosa*) and grand fir (*Abies grandis*). Habitats in northern California and southwestern Oregon may often contain a hardwood component. Tanoak (*Lithocarpus densiflorus*) and black oak (*Quercus kelloggii*) are especially important components in these owl habitats (Raphael, Pers. comm.).

In general, spotted owls occupy forests below 4000 to 5000-foot elevations in western Washington and Oregon, and below 6000-foot elevations in northern California and the east Cascades of Oregon.

Spotted owl use of fir/hemlock forests and ponderosa shrub forests at higher elevations is usually limited to areas where white fir and/or silver fir is a dominant component of the overstory and understory. Spotted owls are rarely found in stands dominated by subalpine fir (*Abies lasiocarpa*) or mountain hemlock (*Tsuga mertensiana*) or in pure stands of ponderosa pine, lodgepole pine (*Pinus contorta*), or Sitka spruce (Forsman et al. 1984; USDA 1988b: III-10).

Spotted owls generally inhabit mature and old-growth forests. Definitions of stands used by spotted owls have often varied among studies. Old-growth forests have usually been defined as having a dominant overstory of trees greater than 200 years old with a multilayered, multiple tree species canopy, relatively high canopy closure, snags and down logs. Mature stands used by spotted owls typically have included a mostly even-aged stand with a minimum age of dominant trees ranging from greater than 70 to greater than 100 years old, and a minimum d.b.h. (diameter measured at 4 $\frac{1}{2}$  feet above the ground) ranging from 16 to 21 inches (Thomas et al. 1990: 146).

Using tree or stand age to signify stand structural characteristics complicates habitat interpretations across geographic areas and between tree species. Trees grow faster and stands develop mature and old-growth forest characteristics more rapidly in areas that have high rainfall, long growing seasons, and gentle winters.

## *The Affected Environment and Environmental Consequences*

Stands can have a mixed-age or even-age structure. Mixed-age stands might be created by partial burns or blowdowns, or by selective harvesting where some trees are left standing. Even-age stands might be created by complete burns or blowdowns, or by clearcut harvesting. Mixed-age stands might provide characteristics of spotted owl nesting, roosting, and foraging habitat at a younger average age than even-age stands.

Structural components that distinguish superior spotted owl habitat from lower quality habitat include:

- A multilayered, multispecies canopy dominated by large (greater than 30 inches d.b.h.) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods.
- A moderate to high (60 to 80 percent) canopy closure that is open enough to allow spotted owls to fly within and beneath it.
- Substantial decadence in the form of large, live coniferous trees with deformities such as cavities, broken tops, and dwarf mistletoe (*Arceuthobium* spp.) infestations.
- Numerous large snags, and ground cover characterized by large accumulations of logs and other woody material (Thomas et al. 1990: 164).

This description is true for forests west of the Cascade crest, the site of most early studies of spotted owls. Ongoing studies will help further clarify if this applies in part or full on the east slope of the Cascades and in northern California.

## **Nesting, Roosting, and Foraging Habitat Studies**

An extensive discussion of results of northern spotted owl habitat studies is presented in the ISC Report (Thomas et al. 1990: Appendix F). Results describe the relationship between the use of various cover types by spotted owls and the availability of those types. Cover types used by spotted owls more frequently than would be expected, based on availability, are considered to have been preferentially selected.

Most spotted owl nests have been encountered in old-growth trees. A variety of nest structures were used, including cavities in trees, broken tops of trees, and platforms. Platform nests included natural accumulations of debris in tree limbs and abandoned nests of hawks, squirrels, or woodrats. Platform nests are frequently located in deformed clumps of limbs resulting from dwarf mistletoe infestation.

Most nests found on the Olympic Peninsula (Forsman Pers. comm.) and in western Oregon were in tree cavities. Nests located in the mixed-conifer forests of the Klamath Mountains of Oregon and on the east slope of the Oregon Cascades were about equally divided between

cavities and platforms. On the east slope of the Washington Cascades, platform nests predominated, often in stands where remnant old trees were heavily infected with dwarf mistletoe (Thomas et al. 1990: 154). In northwestern California, approximately 60 percent of the 69 nests studied were in cavities in the tops of broken trees, 20 percent were in cavities elsewhere in the trunk, and 20 percent were on platforms (Thomas et al. 1990: 160).

Results were similar in ten studies of habitat use by spotted owls in Oregon and Washington that were reviewed by the Interagency Scientific Committee. For both roosting and foraging, old-growth forest was found to be the only stand condition used in greater proportion than its availability by a majority of spotted owls studied, and it was never used less than expected. Mature forests were used in proportion to their availability by a majority of spotted owls. Young stands, those less than 80 years old, were used by most spotted owls either in proportion to their availability, or less than their availability. All of the spotted owls used clearcuts and non-forested areas significantly less than available (Thomas et al. 1990: 152).

Studies in California showed non-random spotted owl use for both roosting and foraging, although comparisons of use versus availability were not made. Research should further define spotted owl habitat use and characteristics for regional areas, such as northern California (Diller, unpublished; Folliard and Reese, unpublished; Kerns, unpublished; Nelson et al., unpublished; Zabel et al., unpublished) and the eastern Cascades of Washington (Buchanan 1991; Everett et al., unpublished; Forsman et al., unpublished; Irwin et al., unpublished).

### Nesting, Roosting, and Foraging Habitat Summary

All studies of habitat use, with the exception of studies in the coastal redwoods of California, suggest that stands with old-growth forest structural components are superior habitat for northern spotted owls. In the redwoods, preliminary studies suggest that forests greater than 80 years old might also provide adequate nesting, roosting, and foraging habitat. This is because redwoods readily sprout from stumps and redwood forests quickly achieve stand structural diversity. There are few redwood-dominated forests on National Forests.

Throughout their range and across all seasons, spotted owls consistently concentrated their foraging and roosting in old-growth or mixed-age stands of mature and old-growth trees.

In the conifer-dominated forest zones where the northern spotted owl lives, succession from an even-aged young stand to a multilayered canopy with decadence may take from 150 to 200 years. In the coastal redwood zone, apparently most or all structural attributes typically

## *The Affected Environment and Environmental Consequences*

associated with the occurrence and breeding of spotted owls develop in perhaps in 50-100 years (Thomas et al. 1990: 165).

For nest sites, spotted owls use primarily old-growth trees, whether in old-growth stands or in remnant old-growth patches. Exceptions in the coastal redwood zone tend to support the observation that spotted owls nest in stands with characteristics of older forests (Thomas et al. 1990: 164).

Studies are currently being conducted to identify habitat use and characteristics on the east side of the Cascades. Preliminary results from a study in the eastern Washington Cascades on the Wenatchee National Forest are inconclusive. In this study it is not readily apparent whether spotted owls consistently selected for either any particular age class or structural characteristics except that owls avoided stands less than 5 inches (13 cm) in diameter (Forsman, Pers. comm.).

Although spotted owls consistently selected mature and old-growth forests in the studies reviewed, considerable use of mid-age and young stands also occurred. This use suggests that as forests develop along the continuum from young to old, they gradually become more suitable for spotted owls. At the same time structural components typical of old-growth forests are sometimes found in young forests, especially those that have regenerated after fire or other disturbances that left behind large trees, snags, and logs from the previous stands (Thomas et al. 1990: 165).

### **Evaluating Nesting, Roosting, and Foraging Habitat at the Forest Level**

Forest stand structures are dynamic. Various types of coniferous forest develop structural characteristics of spotted owl nesting, roosting, and foraging habitat in different timeframes.

Historically, a variety of natural and human-caused factors have repeatedly altered forest structure and composition. For example, variations in fire periodicity, windstorms, volcanic or other catastrophic events have affected ecosystems in which spotted owls have evolved. Therefore, evaluation of stand structural characteristics is a more important factor in determining habitat suitability for spotted owls than tree age.

Most National Forests include a wide range of forest types and conditions, from young forests with inclusions of old-growth trees to very old, multilayered stands in spotted owl habitat. Biologists on each National Forest determined the amount and location of spotted owl habitat based on vegetative characteristics and owl use. Current inventory figures of nesting, roosting, and foraging habitat for each National Forest are presented in Table 3&4 – 3. Many National Forests

recognize quality variations in spotted owl nesting, roosting, and foraging habitat which may be labeled as suitable, classical, typical, atypical or marginal. These variations are based on information available in a variety of databases and local knowledge of forest conditions and spotted owl use. Some examples of types of information used to identify spotted owl habitat include dominant tree species, high canopy closure, large average tree diameter, older aged stands, or elevation. Information on structural characteristics such as amount of dead and down organic material, multicanopy layers, and understory features are generally unavailable in many current data bases. These quality differences are not displayed in this document.

As research expands the current understanding of spotted owl habitat use throughout the subspecies' range, definitions of spotted owl nesting, roosting, and foraging habitat will evolve. Spotted owl habitat descriptions that reflect spotted owl use will change as new information on specific local conditions and habitat use data become available.

**Table 3&4 – 3 Acres of Habitat Within the Range on National Forests**

Total acres<sup>1</sup> and current inventory of spotted owl nesting, roosting, and foraging (NRF) habitat on each National Forest included in this analysis. (in thousands)

National Forest	Total <sup>2</sup> acres	Reserved <sup>3</sup> acres	Total <sup>4</sup> NRF habitat	Reserved <sup>5</sup> NRF habitat
Olympic	632	88	259	33
Mt. Baker-Snoqualmie	1,723	722	658	204
Gifford Pinchot	1,372	292	498	61
Okanogan	1,038	488	87	31
Wenatchee	2,164	841	549	172
Siuslaw <sup>6</sup>	631	22	243	12
Mt. Hood	1,063	189	561	97
Willamette	1,675	387	793	137
Umpqua	984	110	504	26
Deschutes	761	170	129	10
Winema	274	91	84	25
Rouge River	632	94	194	16
Siskiyou	1,092	236	386	66
Shasta-Trinity	2,066	493	270	59
Klamath	1,498	382	409	140
Mendocino	884	137	102	31
Six Rivers	958	266	347	74
<b>Total</b>	<b>19,447</b>	<b>5,008</b>	<b>6,073</b>	<b>1,194</b>

<sup>1</sup>Figures in acres columns are rounded, then added to obtain totals.

<sup>2</sup>Total acres = Total acres of National Forest within the range of the northern spotted owl.

<sup>3</sup>Reserved acres = Total acres of lands withdrawn by Chief's authority or higher (predominantly Wilderness) within the range.

<sup>4</sup>Total NRF habitat = Total acres of spotted owl nesting, roosting, and foraging habitat.

<sup>5</sup>Reserved NRF habitat = Acres of spotted owl nesting, roosting, and foraging habitat on lands withdrawn by Chief's authority or higher.

<sup>6</sup>Acreage figures do not include the Oregon Dunes National Recreation Area

## **Dispersal Habitat**

Dispersal of animals can be defined as the relatively permanent movement of individuals from one location to another, usually juveniles from their natal area to a breeding site or occasionally adults from one breeding site to another. Without successful dispersal, replacement of individuals that are lost from the breeding population through death or emigration will not occur, and the population will decline (Thomas et al. 1990: 303).

Forest lands between designated areas managed primarily for spotted owl habitat provide the connecting link between designated areas. Dispersing spotted owls have a greater chance of survival if forest conditions between designated areas are suitable for foraging and roosting. Habitat conditions must be compatible with the movement of spotted owls; spotted owls must be capable of moving through the habitat and have a tendency to move through the habitat.

Initial dispersal directions taken by juvenile spotted owls appear to be random; subsequent directions cross many forest and topographic boundaries (Miller 1989; Gutierrez et al. 1985). For this reason, dispersal habitat should be distributed across the landscape between designated areas managed primarily for spotted owl habitat.

Forest lands between designated areas managed primarily for spotted owl habitat provide important avenues of dispersal. These areas, referred to as the Forest Matrix in the ISC Report Thomas et al. 1990), provide the connecting links between designated areas managed primarily for spotted owl habitat.

Connectivity can be defined as, “a measure of the extent to which intervening habitat truly connects [designated areas] for juvenile spotted owls dispersing between them” (Thomas et al. 1990: 416). Probability of long-term persistence of the subspecies is sensitive to distances between designated areas managed primarily for spotted owl habitat and to forest conditions in the adjacent landscape.

Long-term persistence or survival depends on successful dispersal which means that designated areas managed primarily for spotted owl habitat must be separated by distances well within the dispersal capabilities of juveniles.

For example, dispersal capabilities were estimated by the Interagency Scientific Committee by summarizing dispersal data collected from radio-marked and leg-banded spotted owls. The ISC Strategy requires that distances between large areas managed for 20 pairs of spotted owls should be within known dispersal ranges of at least two-thirds (67 percent) of all juveniles, or 12 miles (Thomas et al. 1990: 307). Where nesting, roosting, and foraging habitat blocks provide for fewer breeding pairs, a shorter dispersal distance, 7 miles (within the dispersal range of more than 75 percent of juveniles studied) was selected to provide

security and to increase the likelihood of successful dispersal (Thomas et al. 1990: 307-308).

Although dispersal habitat is not intended to provide habitat capable of supporting a pair of breeding owls, it does need to provide stopover places where spotted owls can find suitable cover and especially foraging opportunities which include some forested landscape (Thomas et al. 1990: 309).

## **Home Range**

Home range is the area within which an animal confines its activities for a defined period of time. It normally includes the breeding site and surrounding areas used for foraging. The ISC Report presents a summary of information on home range from various studies in Appendix I of the report. The estimates of the sizes of home ranges used by pairs of spotted owls were calculated from the combined estimate of annual home ranges of paired female and male spotted owls. Home range calculations used 100 percent minimum convex polygon method (Southwood 1966). This method connects the outermost points of an area in which a spotted owl was observed. The area inside the resulting polygon is considered the home range.

### **Home Range Studies**

Northern spotted owl home range data is presented in Table 3&4 – 4. No consistent patterns were detected between home range size relative to forest type or geographic region except that home ranges in the State of Washington were very large compared to most areas farther south.

Although the number of studies is small, evidence indicates that amount of habitat and habitat fragmentation may affect home range size. Spotted owls in areas with more contiguous distributions of old-growth forest had smaller home ranges on average than spotted owls where old-growth forests were more fragmented (Thomas et al. 1990: 153). This suggests that a reduction in the proportional coverage of suitable foraging habitat causes spotted owls to increase the size of their home ranges to encompass additional foraging habitat (Thomas et al. 1990: 197).

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 4 Median Annual Home Range**

Median annual home range areas of spotted owl pairs by physiographic province, adapted from the ISC Report (Thomas et al. 1990: 194).<sup>1</sup> (in acres)

Physiographic province	Sample size	Forest type <sup>2</sup>	Median	Range Minimum	Range Maximum	Sources <sup>3</sup>
Olympic Peninsula	10	HEM/DF	9,930	4,497	27,309	a
Washington Cascades-W	13	DF/HEM	6,308	1,927	30,961	a
Washington Cascades-E	7	MC	7,076	3,673	15,578	b
Oregon Cascades	11	DF/HEM	2,955	1,443	9,758	a
Oregon Coast Range	8	DF/HEM	6,354	3,483	10,189	a
Klamath	32	MC	2,229	1,035	7,823	c

<sup>1</sup>Pair ranges were calculated by delineating 100 percent minimum convex polygon home range areas: total = exclusive area of male plus exclusive area of female plus the area of overlap shared by the two sexes.

<sup>2</sup>MC = mixed-conifer, DF/HEM = Douglas-fir, western hemlock, HEM/DF = mostly western hemlock with Douglas-fir intermixed.

<sup>3</sup>a = Values were taken from the ISC Report. For original sources, please refer to page 194 of the ISC Report. For the Coast Range the values for the Peterson area and Eugene BLM were considered most similar to the Siuslaw National Forest; therefore, these values were used for the Coast Range. b = These values are based on cumulative home range areas (Forsman Pers. comm.). c = Based on linear interpolation of the data presented in the ISC Report (Thomas et al. 1990).

## **Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat**

---

### **Habitat Amount and Trends**

The amount and distribution of northern spotted owl nesting, roosting, and foraging habitat refers to total acreage, its location, and its distribution for supporting breeding pairs of northern spotted owls (USDA 1988b: B1-13).

The amount of northern spotted owl habitat that occurred in the past is difficult to determine. Indications are that as much as 17.5 million acres existed in Washington, Oregon, and California around 1800 (Thomas et al. 1990). The ISC Report (Thomas et al. 1990) estimated that northern spotted owl habitat declined from 17.5 to 7.1 million acres between 1800 and present.

Inventories updated since the ISC Report indicate that there are approximately 8.2 million acres of nesting, roosting, and foraging habitat within the range of the northern spotted owl, of which nearly 75 percent, or 6 million acres, is on land administered by the Forest Service (see Table 3&4 – 3, and Table 3&4 – 5).

Trends in the amount of old-growth forests reflect trends in the amount of spotted owl nesting, roosting, and foraging habitat. Some old-growth forests may not be spotted owl habitat, especially at high elevations, and owl habitat includes more than old-growth forests. Most changes in owl habitat have occurred at lower elevations. Data showed a decline of 59 percent of forests 200 years old and older between the 18th century and today on the Olympic, Mt. Baker-Snoqualmie, Gifford Pinchot, Mt. Hood and Willamette National Forests (Henderson 1990). Franklin and Spies (1984) estimated that nearly 15 million acres of old-growth forest occurred on commercial forest land in the Douglas-fir region of Washington and Oregon in the mid-1800's.

Estimates of northern spotted owl nesting, roosting, and foraging habitat over time are shown in Figure 3&4 – 3. This figure schematically depicts long-term trends in amount of northern spotted owl habitat.

Natural events contribute to fluctuations in amount and distribution of spotted owl habitat. These include wildfire, severe storms resulting in blowdown and flooding, landslides and volcanic events. For example, when Mt. St. Helens erupted in 1980 an estimated 24,000 acres of mature and old-growth Douglas-fir/hemlock forest, much of which contained spotted owl nesting, roosting, and foraging habitat, was destroyed (Ruediger 1985).

Most of the decline in amounts of spotted owl nesting, roosting, and foraging habitat since 1800 has occurred in the last 60 to 70 years. The

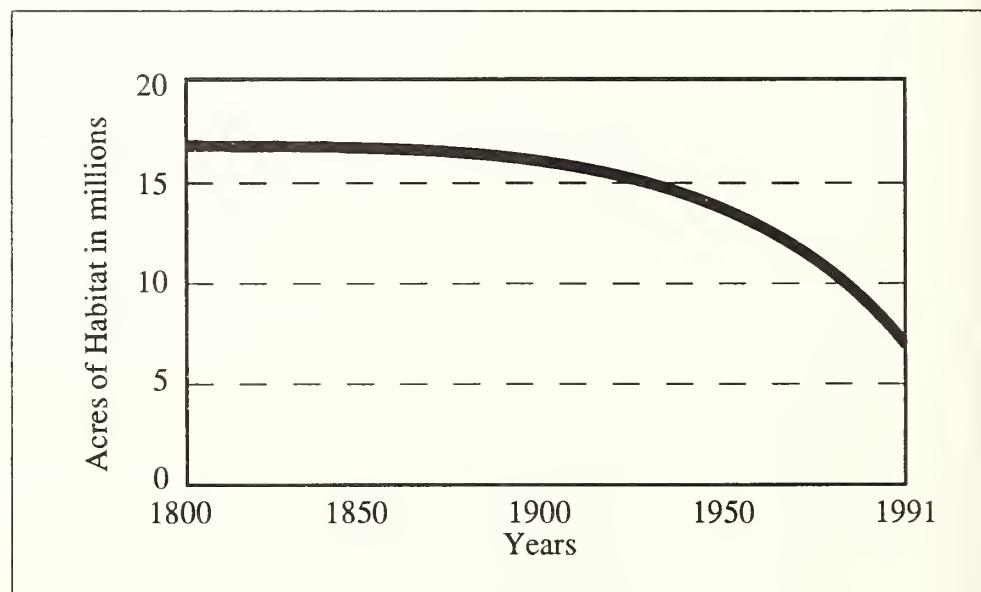
## *The Affected Environment and Environmental Consequences*

rate of habitat loss increased dramatically in the last several decades mostly from clearcut timber harvesting on public and private lands. Franklin and Spies (1984) reported that timber harvest activities resulted in a decline of 67 percent (10 million acres) in old-growth forests in western Oregon and Washington on commercial forest land since 1800.

Spotted owl habitat has been lost more rapidly at lower elevations than at higher elevations (USDA 1988b: III-30 to 33; Anderson et al. 1990: 1). In a few areas, such as the dryer portions of ranges like the east slope Oregon Cascades and in northern California, spotted owl habitat might have increased because of fire protection and resulting changes in forest type and density. Future amounts and trends of northern spotted owl nesting, roosting, and foraging habitat on National Forests are estimated and discussed in the population viability section, criterion 1.

Clearcut harvest techniques over the last 40 years did not result in the same pattern of distribution or types of disturbance that resulted from natural prehistoric fires or other catastrophic events. The harvesting of timber in recent decades has broken up previously contiguous forest cover and has left fewer large live and dead trees and down wood components in the residual stand than previously existed. The result is a landscape that likely, acre for acre, provides for lower densities of spotted owl pairs than occur in more contiguous cover.

**Figure 3&4 – 3 Changes in Owl Habitat 1800 to Present**  
Amount of northern spotted owl habitat from 1800 to present  
(schematic representation of long-term trends).



*Amount and Distribution of Nesting, Roosting, and Foraging Habitat*

**Table 3&4 – 5 Habitat Acres and Owl Pairs on All Lands**

Estimated amounts of northern spotted owl nesting, roosting, and foraging habitat and number of pairs of northern spotted owls located in a 5-year period on all lands in Washington, Oregon, and California. Adapted from the ISC Report (Thomas et al. 1990, Table C1), based on more recent data.

Landowner <sup>1</sup> or agency	Acres of spotted owl nesting, roosting, and foraging (NRF) habitat by timber capability				
	Reserved <sup>2</sup>	Unsuited <sup>3</sup> for timber	Suited <sup>4</sup> for timber	Total acres <sup>5</sup>	Total known <sup>6</sup> owl pairs
FS, WA	500,000	804,000	747,000	2,051,000	475 <sup>7</sup>
FS, OR	390,000	1,058,000	1,447,000	2,895,000	1,330 <sup>7</sup>
FS, CA	304,000	519,000	305,000	1,128,000	615 <sup>7</sup>
BLM, WA	8--	--	--	--	--
BLM, OR	158,000	--	873,000 <sup>9</sup>	1,031,000 <sup>9</sup>	541 <sup>10</sup>
BLM, CA	13,000	--	6,000	19,000	11
NPS, WA	480,000	0	0	480,000	20
NPS, OR	50,000	0	0	50,000	4 <sup>11</sup>
NPS, CA	40,000	0	0	40,000	2
Tribal lands, WA	--	--	257,000	257,000	10 <sup>11</sup>
Tribal lands, OR	--	--	54,000	54,000	18 <sup>11</sup>
Tribal lands, CA	--	--	32,000	32,000	28 <sup>11</sup>
FWS, WA	1,700	--	5,000	6,700	0
FWS, OR	4,100	--	--	4,100	0
WDNR, WA	--	--	--	--	33
WDW, WA	0	--	5,000	5,000	0
State Parks, WA	2,000	0	0	2,000	0
Cities of Seattle, Tacoma	0	0	1,500	1,500	0
ODF	0	--	77,000	77,000	28 <sup>11</sup>
State Parks, OR	8,000	0	0	8,000	2 <sup>11</sup>
Counties and cities, OR	--	--	--	--	1 <sup>11</sup>
CDF	--	--	--	--	4
State Parks, CA	56,000	0	0	56,000	10
State Lands Comm., CA	--	--	--	--	10
BLM/TNC, CA	6,500	0	0	6,500	0
NAS, CA	600	0	0	600	1
Private, CA	--	--	--	--	235 <sup>11</sup>
Private, OR	--	--	--	--	50 <sup>11</sup>
Private, WA	--	--	--	--	31
<b>Totals</b>	<b>2,013,900</b>	<b>2,176,000</b>	<b>4,013,500</b>	<b>8,204,400</b>	<b>3,461</b>

<sup>1</sup>See Appendix C - Management of Other Lands for information on acronyms.

<sup>2</sup>Reserved NRF habitat = Withdrawn from timber harvest (for example Wilderness and Research Natural Areas).

<sup>3</sup>Unsuitable for timber = Lands unsuitable for timber production because of allocation to other uses by Forest Plans, or technically unsuitable for timber production because of soil problems or difficult regeneration.

<sup>4</sup>Suitable for timber = Lands allocated for timber production by land management plans.

<sup>5</sup>Total acres of NRF habitat = total acres of nesting, roosting, and foraging habitat.

<sup>6</sup>Total northern spotted owl pairs on all lands in a 5-year period.

<sup>7</sup>Spotted owl pairs reported 1987 through 1991 rounded to the nearest five pairs.

<sup>8--</sup> = Reliable estimate not available.

<sup>9</sup>Suitable timber for BLM does not reflect nesting, roosting, and foraging habitat harvested since 1988.

<sup>10</sup>Spotted owl pairs reported from 1986 through 1990.

<sup>11</sup>Spotted owl pairs reported from 1987 to July 1991.

## *The Affected Environment and Environmental Consequences*

### **Current Management of Other Lands**

This environmental impact statement deals only with management of spotted owl habitat on National Forests. This section lists lands other than National Forests, within the range of the northern spotted owl. Providing a sound conservation strategy for the northern spotted owl must rely on management of more than just National Forests; therefore, this information is provided. Spotted owl management on other lands might augment spotted owl management on National Forests.

In June 1990 the U.S. Fish and Wildlife Service published "Interim Procedures Leading to Endangered Species Act Compliance for the Northern Spotted Owl." This document includes formal consultation guidance for Federal projects, interim recovery strategy, conservation planning for nonfederal actions, and guidance for incidental take. Under the Endangered Species Act, U.S. Fish and Wildlife Service guidelines refer to incidental take as indirectly affecting spotted owls, such that they may not survive, as in removal of habitat (USDI 1990a).

### **Federal Lands**

**Bureau of Land Management (BLM).** The BLM administers lands in the geographic range of the northern spotted owl in all three States, but only BLM lands in Oregon and California are occupied by spotted owls. Most of these lands are in Oregon. Because of topographic features, inherent plant community types, and land ownership patterns, BLM lands in Washington have limited potential to support spotted owl nesting, roosting, and foraging habitat.

When the U.S. Fish and Wildlife Service listed the northern spotted owl as Threatened on June 22, 1990, the BLM called for the implementation of the Jamison Strategy (USDI, unpublished). The Jamison Strategy was to provide interim guidance for BLM management of western Oregon forest lands until resource management plans are completed in 1993.

Since the Jamison Strategy was announced, Bureau of Land Management in Oregon received "jeopardy opinions" from the U.S. Fish and Wildlife Service in June 1991 on 44 proposed timber sales. The agency has applied for an exemption from the requirements of the Endangered Species Act under Section 7(g).

BLM's current direction addresses the 1992 timber sale plans and spotted owl management by directing the field offices to offer the maximum volume of timber within the constraints of present western Oregon forest land use and timber management plans, while keeping spotted owl management protection options open to be resolved in future resource management plans. To date, BLM has not made any irreversible or irretrievable commitments of resources which would foreclose options for management of spotted owl habitat in accordance with the U.S. Fish and Wildlife Service recommendations.

### *Amount and Distribution of Nesting, Roosting, and Foraging Habitat*

Management in the Ukiah District in California, while not adopting the ISC Strategy, is following the guidelines fairly closely and consulting with the U.S. Fish and Wildlife Service (USDI 1990a). The District manages Category 1 Habitat Conservation Areas (HCAs) with the Forest Service and Category 3 and 4 HCAs on BLM lands. The Arcata Resource Area within the Ukiah District has the majority of the HCAs, totaling 26. No timber sales are being planned in the HCAs, and the 50-11-40 rule is being followed for most lands outside HCAs. Each resource area is in the process of completing a resource management plan. No timetable is available.

**National Park Service.** Management objectives for National Parks are considered compatible with maintaining spotted owl habitat. Congressionally designated Wilderness and National Park systems contain less than 1.8 million acres of nesting, roosting, and foraging habitat spread out over the range of the spotted owl, and may support fewer than 300 pairs of spotted owls (Thomas et al. 1990). While these lands are considered to be essential to protecting the subspecies, they do not, by themselves, support adequate protection for spotted owls, nor would they support a viable population.

**U.S. Fish and Wildlife Service.** Four National Wildlife Refuges administered by the U.S. Fish and Wildlife Service contain spotted owl habitat. Most of the 5,000-acre Willapa National Wildlife Refuge, with the exception of a 274-acre old-growth reserve, is available for timber harvest because of an agreement tied to its acquisition. Timber harvest could be curtailed if spotted owls were observed in the area. Another National Wildlife Refuge in Washington, Conboy Lake National Wildlife Refuge (about 1,500 acres), and two in Oregon, Cape Meares (138 acres) and Bear Valley (about 4,000 acres), are not currently managed for timber production.

**Fort Lewis Military Reservation.** South of Tacoma, Washington, the Fort Lewis Military Reservation includes about 68,000 acres of contiguous forest which is not currently considered spotted owl nesting, roosting, and foraging habitat. Surveys for spotted owls were conducted in 1991 on the reservation to provide information for consultations with the U.S. Fish and Wildlife Service.

## **Indian Tribal Lands**

Lands of the Quinault, Makah, Yakima, Confederated Warm Springs, Confederated Grande Ronde, Siletz, Hoopa, and Round Valley Tribes contain significant acreages of commercial forest land. Current policy for management of spotted owl habitat on tribal lands is to follow U.S. Fish and Wildlife Service guidelines (USDI 1990a). Managing for dispersal habitat varies by reservation.

## *The Affected Environment and Environmental Consequences*

### **State and Private Lands**

**State of Washington.** Management guidelines for the Washington Department of Natural Resources, Washington Department of Wildlife, Washington State Parks, and private lands in Washington are as follows:

The northern spotted owl is listed as an Endangered species by the Washington Department of Wildlife. Washington Department of Natural Resources regulates forest practices on nonfederal lands. Their guidelines for processing and writing conditions for forest practice application are based on the Forest Practices Act, State Environmental Policy Act, and biological information and recommendations from the U.S. Fish and Wildlife Service (USDI 1990a) and Washington Department of Wildlife. The Department of Natural Resources guidelines for spotted owl management, called regulatory procedures, are adopted from U.S. Fish and Wildlife Service biological criteria with some modifications. The State process requires nonfederal landowners to meet these regulatory procedures. In some cases where Washington Department of Natural Resources regulatory procedures may not meet U.S. Fish and Wildlife Service guidelines, the Fish and Wildlife Service may impose additional requirements on the landowner (Hayes Pers. comm.).

**State of Oregon.** Management guidelines for the Oregon Department of Fish and Wildlife, Oregon State Board of Forestry and State Land Board, and private lands in Oregon are as follows:

The spotted owl is listed as Threatened in Oregon by the Fish and Wildlife Commission. Oregon's listing of threatened and endangered species requires that protection be given the species on State lands only, not private lands. All State agencies must coordinate with Oregon Department of Fish and Wildlife when a project or action may affect a listed species. Forest management operations on State and private lands are governed by rules under the Oregon Forest Practices Act. The Oregon Forest Practices Act was amended in 1987 and requires that the Board of Forestry adopt rules to protect State-listed species or nest sites of sensitive birds. Interim rules have been adopted that require a written plan to be approved by the State Forester when any forest operation is proposed within 300 feet of a nesting or roosting site of a listed species.

Currently, northern spotted owls are being managed on Oregon State lands in accordance with U.S. Fish and Wildlife Service guidelines (USDI 1990a). Spotted owls on private lands are being managed in accordance with the Oregon Forest Practices Act, which requires delineating 70 acres of the best suitable habitat around each known spotted owl nest site or activity center (Johnson Pers. comm.).

Management plans have been prepared for about half of the parks in the Oregon State Parks system. Current direction for forest lands is generally protection, except that individual trees which are considered safety hazards can be removed.

## *Amount and Distribution of Nesting, Roosting, and Foraging Habitat*

**State of California.** Management guidelines for the California Department of Forestry and Fire Protection, California Department of Fish and Game, and private lands in California are as follows:

The northern spotted owl is listed as a Species of Concern by the California Department of Fish and Game. A timber harvest plan must be submitted by the landowner and approved by the California Department of Forestry for any proposed nonfederal project. The California Board of Forestry adopted regulations based on U.S. Fish and Wildlife Service guidelines (USDI 1990a) for evaluating timber harvest plan effects on spotted owls. The California Department of Fish and Game reviews each plan to determine if it meets California Board of Forestry established criteria. The timber harvest plan rule process is only intended to remain in effect until a habitat conservation plan covering private lands in the State of California is approved by the U.S. Fish and Wildlife Service.

The timber harvest plan rules require surveys and specific protection measures for all discovered spotted owls, or if no surveys are conducted, a broader habitat protection plan must be developed before timber harvest can begin. In addition to timber harvest plans, a larger habitat protection plan, the Spotted Owl Resource Plan which uses site-specific information to develop protection measures, will allow harvest without significantly impacting spotted owl habitat or diminishing habitat viability. The Spotted Owl Resource Plan necessarily involves more than one timber harvest plan area.

## **Other Land Ownerships**

**City of Seattle.** The Seattle Water Department manages about 68,000 acres of forested land. About 3,000 acres remain in old-growth forest condition. Current management provides for the preservation of all existing old-growth forest; in addition, 50 to 65 percent, or about 40,000 acres, of second-growth forest will be managed as a permanent reserve which will provide spotted owl habitat.

**The Nature Conservancy.** Management direction for the Northern California Coast Range Preserve and the McCloud River Preserve areas is to maintain the natural qualities of the area, including old-growth Douglas-fir forests which will provide spotted owl habitat.

**National Audubon Society.** The National Audubon Society manages a 1,000-acre tract of second-growth redwood forest in coastal Marin County. The area provides about 600 acres of nesting, roosting, and foraging habitat. Current direction is to manage the area for its natural values, including the redwood forest. The Society also owns a 116-acre inholding surrounded by the Siuslaw National Forest of which 46 acres are nesting, roosting, and foraging habitat.

*The Affected Environment and Environmental Consequences*

This page left blank for notes

## **Issues Related to Distribution of Spotted Owl Habitat and Populations**

### **Habitat Patch Size and Edge**

Dispersed clearcut harvest, the historic timber harvest practice on National Forests and other lands throughout the range of the northern spotted owl, has reduced the amount and distribution of spotted owl nesting, roosting, and foraging habitat, as well as the size of the remaining patches of this habitat. It has also increased the amount of habitat edge.

Clearcutting reduces northern spotted owl nesting, roosting, and foraging habitat and leaves remaining patches of old forest surrounded by young forest, creating an edge between seral stages. The smaller the remaining nesting, roosting, and foraging habitat patch, the larger the ratio of edge to habitat area, and the greater the potential for species invasion and change in interior forest microclimate. Thus, the effective size of the habitat patch is reduced as a result of the edge.

Invasion of edge-dwelling species into interior habitats can affect the survival of forest interior species (Thomas 1990: 274). An increase in the amount of forest edge hypothetically corresponds to an increase in potential for northern spotted owl competition with barred owls and predation by great horned owls (Thomas 1990: 274).

On a larger scale, an area of contiguous habitat probably supports a larger number of northern spotted owl pairs than an equal amount of habitat distributed as small patches. There is evidence that populations are declining due to habitat loss (USDA 1988b; Anderson 1990), but the effects of reducing habitat patch size and increasing the amount of forest edge on population changes are less clear.

### **Isolation of Northern Spotted Owl Populations**

Maintaining geographic distribution of northern spotted owls throughout their present range on National Forests in Washington, Oregon, and California is a primary concern. Small, isolated populations are potentially highly vulnerable to adverse demographic, genetic, and catastrophic factors. Isolation is a concern for persistence of clusters of pairs as well as for entire populations. Isolation can decrease diversity of the gene pool for the subspecies.

Current ecological thinking suggests that as genetic diversity is decreased, adaptability to change, fertility, and fitness of offspring are negatively impacted. Events which can lead to a loss of genetic variability (such as inbreeding and population bottlenecks) are serious problems for small, isolated populations. A small, isolated population may be difficult to maintain without genetic or demographic contributions from other populations.

## *The Affected Environment and Environmental Consequences*

To maintain outbreeding such that diversity of the genetic stock does not suffer significant losses due to genetic drift or inbreeding, it is hypothesized that perhaps two to four emigrants per generation need to move to and breed with the population isolate (Marcot Pers. comm.).

To offset a demographic decline or to restock a population area in which spotted owls have gone locally extinct would entail on the order of 20 to 40 emigrants per generation (Marcot Pers. comm.). Therefore, if a few northern spotted owls emigrate across the Columbia Gorge or Puget Sound, for instance, they might offset loss of genetic diversity but not at a rate to allow rescue effect to occur.

Isolation may decrease the success of dispersing juveniles and inhibit movements of adults between clusters of pairs. Studies suggest that populations separated by over 20 miles may have difficulty interacting on a regular basis, and those separated by more than 62 miles probably rarely interact (USDA 1988b: III-23, 24).

## **Catastrophic Events**

Large scale events such as fire, drought, floods, windstorms and volcanic eruptions can destroy large areas of spotted owl nesting, roosting, and foraging habitat. Designation of large areas managed primarily for spotted owl habitat and spacing such that dispersing spotted owls have a reasonable likelihood of finding them, would be more effective at retaining both nesting, roosting, and foraging habitat and interactive spotted owl populations than would designating smaller areas for spotted owls. A single catastrophic event has a greater chance of eliminating an entire small designated area than a large designated area (Thomas et al. 1990).

## **Areas of Concern for Management of the Northern Spotted Owl**

Maintaining the geographic distribution of northern spotted owl populations throughout the Pacific Northwest is a management concern (Thomas et al. 1991: 64). Quality and quantity of northern spotted owl nesting, roosting, and foraging habitat varies within and among physiographic provinces as a result of natural and human-related activities. Large wildfires, volcanic eruptions, and site-specific characteristics of an area can play a major role in the natural distribution of habitat. Mixed ownership patterns with a range of land treatments ranging from full habitat protection to significant reductions in amounts of spotted owl habitat result in human-caused alterations in habitat distribution. A few of these natural and human-caused conditions on the landscape have resulted in areas of special concern within the physiographic provinces. Loss of nesting, roosting, and foraging habitat, especially in key linkage areas, may reduce the value of the remaining habitat and may decrease the interaction of spotted owls in several locations in the Pacific Northwest (USDA 1988: III-23, 24). Identified areas of concern encompass portions of the spotted owl's

### *Amount and Distribution of Nesting, Roosting, and Foraging Habitat*

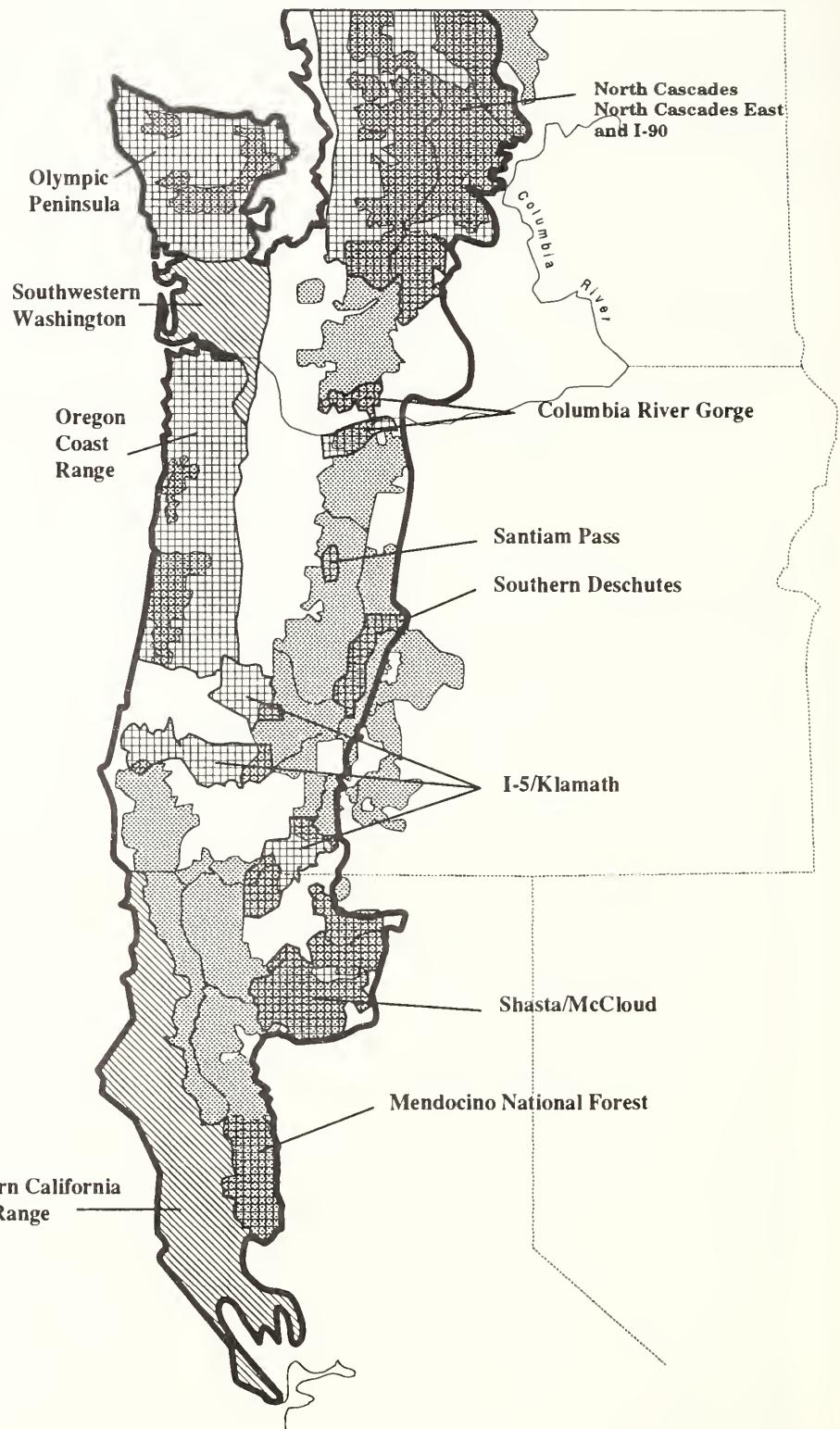
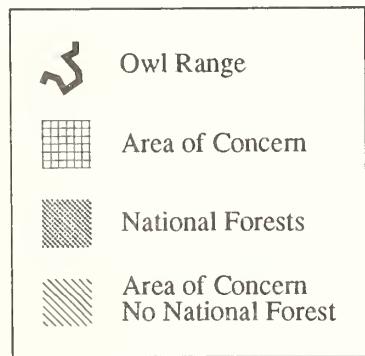
range that impose a high risk of isolating populations, or that act as critical links or barriers between populations.

Areas of concern are identified in Figure 3&4 – 4 and followed by a list including the reason for identification. Information on areas of concern was compiled from USDA 1988b; Thomas et al. 1990; Anderson et al. 1990; and 36 CFR 40008.

**Olympic Peninsula.** Isolation of spotted owls due to lack of linkage to other provinces; poor distribution and quality of existing nesting, roosting, and foraging habitat; high level of fragmentation; small northern spotted owl population size; and variable to low reproductive success.

**Southwestern Washington.** Lack of connectivity; little remaining nesting, roosting, and foraging habitat; poor distribution and quality of existing nesting, roosting, and foraging habitat; very small northern spotted owl population size; and lack of Federally owned land. No National Forests occur in this area of concern.

**Figure 3&4 – 4**  
**Areas of**  
**Concern for**  
**Management**  
**of the**  
**Northern**  
**Spotted Owl**



*Amount and Distribution of Nesting, Roosting, and Foraging Habitat*

**North Cascades, North Cascades East, and I-90.** Poor distribution and quality of existing nesting, roosting, and foraging habitat; high level of natural and human-caused fragmentation (e.g., North Cascades); small northern spotted owl population size; variable reproductive success; competition with barred owls; and localized deficiencies in habitat connectivity.

**Columbia River Gorge.** Potential barrier between Oregon and Washington Cascade Ranges.

**Oregon Coast Range.** Small northern spotted owl population size; poor distribution and quality of existing nesting, roosting, and foraging habitat; high level of fragmentation; lack of sufficient linkage to other physiographic provinces; low reproductive success; and large areas of land not in Federal ownership.

**Santiam Pass.** Deficiency in habitat connectivity; poor distribution and quality of existing nesting, roosting, and foraging habitat; and high level of fragmentation.

**I-5/Klamath (Southern Oregon).** Poor distribution and quality of existing nesting, roosting, and foraging habitat in some areas; high level of natural and human-caused fragmentation; and localized deficiencies in habitat connectivity.

**Southern Deschutes.** Deficiency in habitat connectivity; poor distribution and quality of nesting, roosting, and foraging habitat; high level of fragmentation; and small northern spotted owl population size.

**Shasta/McCloud.** Small northern spotted owl population size; poor distribution and quality of existing nesting, roosting, and foraging habitat; high level of natural and human-caused fragmentation; poor reproductive success; insufficient linkage among physiographic provinces and with the range of the California spotted owl; and intermingled landownership.

**Mendocino National Forest.** Poor distribution and quality of existing nesting, roosting, and foraging habitat; and high level of natural and human-caused fragmentation.

**Northern California Coast Range.** High level of human-caused fragmentation; and lack of Federally owned land. No National Forests occur in this area of concern.

This page left blank for notes

## Population Biology

---

### Abundance and Distribution of Northern Spotted Owls

Documented observations of northern spotted owls date back to the 1800's. Extensive efforts to gather information on northern spotted owls have occurred in the last 20 years through general surveys, coordinated monitoring, and research projects.

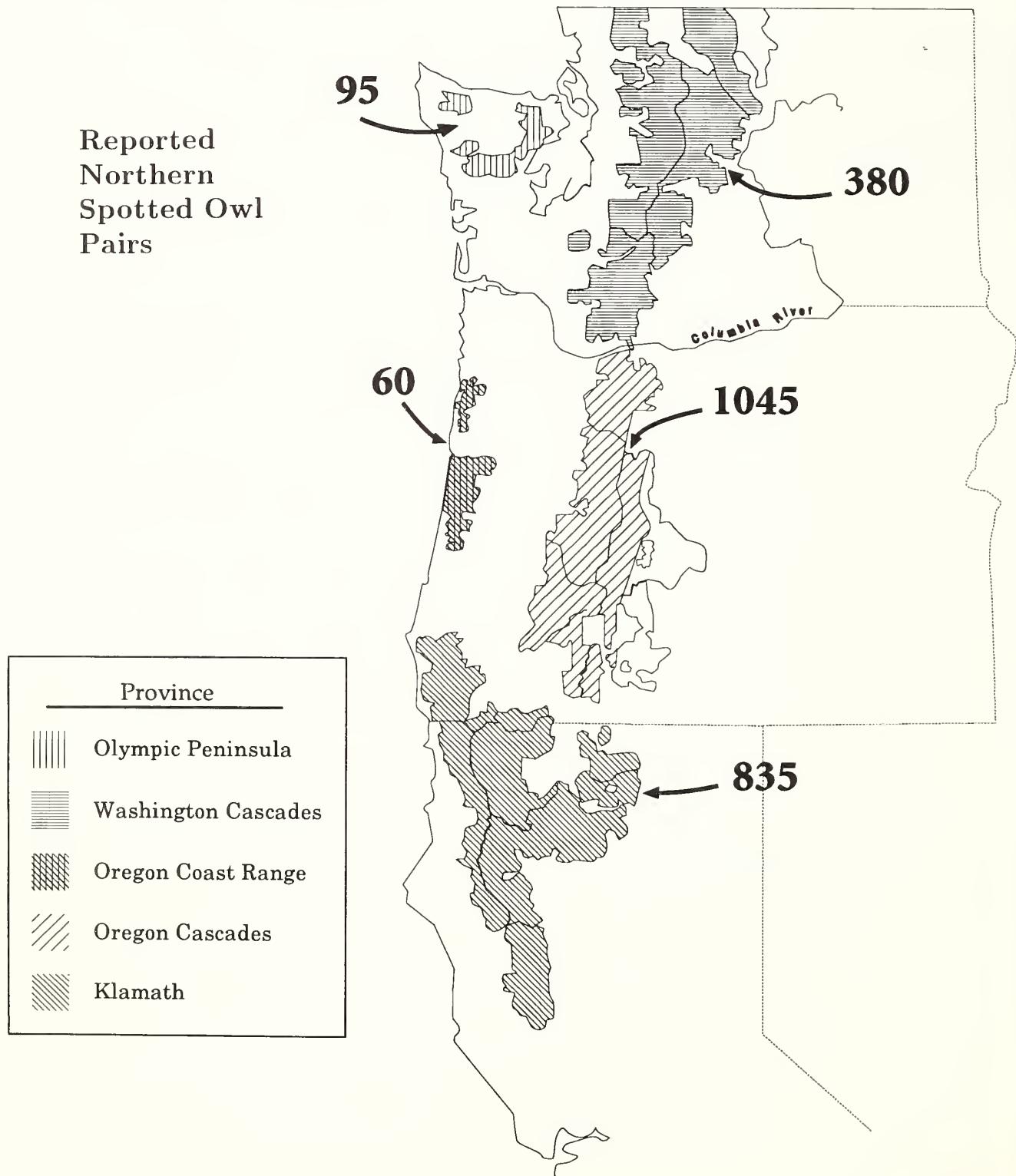
Numbers of northern spotted owl pairs are generally compiled from survey, monitoring, and research efforts, generally during the breeding season from March 1 to August 31, over a 5-year period. Because of variation in funding and staffing and changes in priorities for survey work, all forests potentially suitable for northern spotted owls are not surveyed each year. In addition, not all spotted owls present are always detected. In a case like this, the actual numbers of owls present might be higher than reported. Spotted owls have large home ranges and might be detected at different locations within their home ranges. Unless each spotted owl has received a leg band and bands are confirmed each time the the owl individual or pair is located, it is difficult to determine when the same spotted owl is located at different sites. Thus the same spotted owl may have been reported at two different sitings. In this case, actual numbers of owls present might be lower than reported for a 5-year compilation. Therefore, it is misleading to interpret survey results as an accurate and complete census of all spotted owls in an area. Further, totals shown in Table 3&4 – 5 and Figure 3&4 – 5 include owl pairs from surveys before the 5-year period if habitat has not been reduced significantly since the area was last surveyed.

Approximately 3,460 northern spotted owl pairs were reported between 1986 and 1991. Approximately 2,420 or 70 percent, were reported from National Forests between 1987 and 1991. Bureau of Land Management lands account for another 552 pairs, or 16 percent, of reported pair locations (see Table 3&4 – 5). The approximate number of spotted owl pairs reported for the 1987 to 1991 period on National Forests by physiographic province are listed in Figure 3&4 – 5.

The highest concentrations of spotted owl densities and numbers occur in the southern portion of the Washington Cascades Province, the Oregon Cascades Province, and the Klamath Province. The Coast Range Province of northwestern California, which contains no National Forests, also has high densities and numbers of spotted owls. Significantly lower numbers and densities are found elsewhere within the range (Thomas et al. 1990: 63). To some extent, densities and numbers reflect the true capability of the land to support spotted owl pairs, but they also reflect the intensity and frequency of owl surveys in the area.

**Figure 3&4 - 5 Reported Northern Spotted Owl Pairs**

Numbers of northern spotted owl pairs reported on National Forests through the 1991 field season by physiographic province. Numbers are rounded to the nearest five pairs and may not add to totals in other tables. These figures do not represent potential habitat capability or a complete census of all owl pairs.



## Population Structure

Populations of northern spotted owls appear to be declining, which may reflect a higher death rate than birth rate. Scientifically conducted studies to determine population status and trends of the northern spotted owl help land managers to track and respond to population trends. These studies, called demographic studies, include statistical analyses of population characteristics such as birth and death rates and age structure.

A population can be characterized as being comprised of several sets of ages, or stage classes. These stage classes include:

- Juvenile - from young leaving the nest, or fledgling, to dispersal
- Subadult - the next 1 to 2 years, depending on author
- Adult - all years thereafter.

Each stage class has specific survival and reproduction rates associated with it, including:

- Juvenile survival - the likelihood that new birds will live through the first year of life
- Subadult survival - the likelihood birds will live through their second or third year of life
- Adult survival - the annual survival rate of adult birds
- Fledgling rate - the average number of young per adult female produced and survived to fledgling stage each year
- Fecundity rate - the number of female young produced per adult female per year

Initial analysis of data from five spotted owl demographic study areas in Washington, Oregon and northern California indicate that populations are declining in all five study areas (Forsman Pers. comm.).

After a preliminary review of new studies, the demographic parameter values used in the ISC Report for determining spotted owl population status and trends have not changed significantly (Forsman Pers. comm.; 56 FR 40010).

Modification and loss of spotted owl nesting, roosting, and foraging habitat might force more owls to move to remaining stands in conditions suitable for nesting, roosting, and foraging habitat than these stands can support over the long term. Under these conditions there is an increased potential for packing. This is a term used to describe temporary influx of organisms of various age classes and sex into remaining nesting, roosting, and foraging habitat because previously available habitat has changed to unsuitable conditions. Packed owls and floater owls could increase competition for the remaining resources, thus creating stress on the population, and possibly resulting in a population decline until a new equilibrium is reached (Anderson et al. 1990: 38, 44; Thomas et al. 1990: 278).

## **Factors Influencing Northern Spotted Owl Populations**

### **Modification and Loss of Habitat**

The current decline in populations of the northern spotted owl is due primarily to modification and loss of nesting, roosting, and foraging habitat. Anderson et al. (1990: 44) states, “Even if the harvest of old-growth and mature forests were halted, the owl population would likely decline markedly for several years and will decline at a reduced rate for several generations until it equilibrates with the carrying capacity.”

### **Relationship Between Prey Availability and Spotted Owl Reproduction**

Although prey abundance levels can influence survival of individual spotted owls, little empirical information exists on the effects of prey abundance on reproductive success in northern spotted owls. Most studies have not drawn clear conclusions on this relationship (Thomas et al. 1990). Studies of other owls, including the tawny owl (*Strix aluco*) (the same genus, *Strix*, as the spotted owl) and the great horned owl (*Bubo virginianus*) showed a close association between prey abundance and reproductive success. Tawny owls would not attempt breeding when prey was unavailable (Thomas et al. 1990).

### **Habitat of Prey Species**

Managing for northern spotted owls includes consideration of habitat for the prey species on which spotted owls feed. Timber harvest activity affects the number of prey species and population abundance, and thus the availability of each prey species for spotted owls (Thomas et al. 1990).

Studies show a strong preference by spotted owls for small nocturnal mammals. Northern flying squirrels, dusky-footed woodrats (*Neotoma fuscipes*), bushy-tailed woodrats (*Neotoma cinerea*), hares (*Lepus spp.*), and rabbits (*Sylvilagus spp.*) in general comprise the main prey species eaten by northern spotted owls. Other prey species of importance in some physiographic provinces of the northern spotted owl are pocket gophers (*Thomomys spp.*), red tree voles (*Arborimus longicaudus*), and deer mice (*Peromyscus spp.*) (Thomas et al. 1990).

Habitat preferences of spotted owl prey species vary. In general, flying squirrels are not found in clearcuts and forested areas less than 20 years old. Some research shows flying squirrels use stands 30 to 60 years old and old-growth stands equally. In a northwestern California study, flying squirrel abundance tended to increase as old-growth patch size increased (Thomas et al. 1990: 205). In the Oregon Coast Range, the northern flying squirrel appears to be associated with late-successional forests (Ruggiero et al. 1991).

Dusky-footed woodrats are abundant in brushy clearcuts where hardwoods and shrubs predominate in excess of typical clearcuts (Raphael Pers. comm.). Their numbers drop in even-age forested areas and likely increase at least somewhat in older forests. Bushy-tailed woodrats are tied more to structural components of habitat such as cliffs, rock outcrops, and hollow logs or trees (Thomas et al. 1990). Both species of woodrat seem to be associated with riparian areas (Raphael Pers. comm.).

### Immigration by Floaters

Floaters are non-breeding adult and subadult owls that move and live within a breeding population, have the potential to replace breeding adults. The distribution of floaters and their impact on the spotted owl community is not well studied. Studying dynamics of floaters within a population is a difficult task because they tend to be inconspicuous.

Some floaters may eventually replace reproductive spotted owls when they die (Thomas et al. 1990; Anderson et al. 1990), providing a beneficial effect to the population sometimes called a “rescue effect” (Brown and Brown 1977). Immigrants, or floaters, as opposed to surviving young (internal recruits), made up the majority of new entries into two study populations: one in northwestern California and another in the Roseburg area in southwestern Oregon. Anderson et al. (1990) suggests that, “The floating population probably contributes most of the immigrants and masks the extent of decline in the number of territorial breeders.”

### Hybridization

There are three documented occurrences of hybridization between northern spotted owls and barred owls (*Strix varia*), both members of the same genus. The barred owl is slightly larger and has streaking on the lower abdomen instead of the white mottling of the spotted owl. Differences in markings between the two species and hybrids can be difficult to detect.

Of the documented hybrid occurrences, two male hybrid owls are paired with female barred owls, and one female hybrid owl is paired with a male spotted owl. One male hybrid owl/female spotted owl pair in the Roseburg area produced young in 1990 and 1991 (Forsman Pers. comm.; Hamer Pers. comm.). It is not yet known if these young are in turn fertile. In Europe, records exist of tawny owls (*Strix aluco*) and ural owls (*Strix uralensis*) hybridizing in captivity and producing fertile young (Scherzinger 1983; Voous 1988).

More cases of spotted/barred owl hybridization are likely to be discovered as field personnel learn to clearly identify and record hybrid

## *The Affected Environment and Environmental Consequences*

occurrences. At this time, the frequency of hybridization is so low it is not of concern and may actually indicate a strong selection against breeding between these species (Forsman Pers. comm.; Hamer Pers. comm.).

### **General Trend**

It is the combined effects of environmental factors external to populations and population dynamics or factors internal to populations that will determine the survival of the northern spotted owl. The current status of the northern spotted owl is described in the 1990 Status Review of The Northern Spotted Owl:

"There has been a dramatic loss of suitable habitat throughout the range of the northern spotted owl (e.g., Section 2 and Thomas et al. 1990). It seems nearly certain that the population of owls has declined substantially throughout its range as a result of habitat loss. More important, perhaps, is the high likelihood that the population is currently above carrying capacity in remaining areas. The floater component is probably large, juvenile survival is probably poor, and fecundity is depressed as consequences of artificially (and temporarily) high density. Franklin, et al. (1990b: 6) presented evidence of packing, where birds crowd territories into remaining suitable habitat. Packing, plus the effect of the floating component of the population, leads to increased competition for resources, which affects survival and fecundity rates." (Anderson et al. 1990: 38)

Land management practices that reduce and fragment spotted owl habitat and isolate populations of the spotted owl have the greatest negative impact on population stability and viability of the subspecies.

# Population Viability

---

## Population Viability Analysis

Population viability is the chance or likelihood that a wildlife population will persist in an area over a specified period of time (Shaffer 1981, 1983; Schonewald-Cox et al. 1983). A wildlife population must be large enough to endure and rebound from periods of low numbers; and it must be distributed widely enough to ensure maintenance of its genetic diversity as well as ensure sources of dispersing and recolonizing individuals. If population size or distribution are inadequate, the population will have a low likelihood of persistence over time.

Population viability analysis is a procedure used to indicate the degree of risk to continued existence of a species or subspecies in an area under a particular habitat management plan. Risk to future existence may come from known perils in the environment such as loss of habitat. Another risk is generated from uncertainty of future conditions. Because of such uncertainty, viability of a population is described as the likelihood that the species or subspecies will persist in well distributed spatial patterns over time (Salwasser et al. 1984).

In the context of this document, population viability analysis describes the chances that northern spotted owl populations will persist in well distributed patterns throughout National Forests over the long term.

## Legal Requirements for Managing Viable Populations

Population viability of northern spotted owls was analyzed because of Federal legal mandates in the planning regulations implementing Section 6 of the National Forest Management Act (NFMA) of 1976 and pursuant regulations (36 CFR 219; Planning Regulations for implementing Section 6 of NFMA).

The planning regulations (36 CFR 219.19) state:

**"Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area."**

In this document, the planning area is defined as the range of the northern spotted owl on National Forests. Analysis for this environmental impact statement also considered occurrence of northern spotted owls on other

## *The Affected Environment and Environmental Consequences*

lands within the geographic range of the subspecies because these lands contribute to viability of populations in National Forests. It is assumed that other land managers will manage their lands in accordance with the Endangered Species Act, Section 7(a). Specifically, it is assumed that as a result of consultation with the U.S. Fish and Wildlife Service, other Federal agencies will manage their lands with a level of spotted owl protection similar to that of the ISC Strategy.

The aim of viability analysis is to determine the combined effects of specific biological and environmental factors that can influence population persistence. These effects vary among planning alternatives, geographic locations, spotted owl populations, and over time.

### **Factors Influencing Population Viability**

The following categories contain the principle factors that can affect the persistence of wildlife populations.

#### **Factors Internal to the Population:**

- changes in demographic attributes of the population (essentially, rates of birth and death)
- the degree of genetic variation within and among individuals in the population
- other behavioral attributes of individuals of the population such as patterns and distances of dispersing juvenile individuals, breeding biology, and patterns and specificity of habitat selection

**Demographic Attributes.** Birth and death rates determine the overall trend of population growth or decline. A stable or increasing population must be one with birth rates equal to or exceeding death rates. Also, the degree to which such rates vary over time, such as among several subsequent years, can greatly influence the likelihood of persistence of the population. If availability of food, fluctuations in weather patterns, or other external factors result in several years with poor reproductive success (few young born that live to breed) or greater rates of mortality than usual, the population might decline to imperiled levels or might become extinct.

**Genetic Variation.** Genetic variation addresses the variety of genes present within and among individuals in the population. The degree of genetic variation in a population determines how well the population can adapt to changes in the environment over time. A small, isolated population generally suffers greater losses of genetic variation. Small and isolated populations are therefore particularly vulnerable and unable to adapt to major, long-term changes in prey, climate, presence of competitors and predators, and a host of other environmental factors.

**Breeding Biology.** Small populations can lose genetic variation because there are fewer individuals to maintain and pass on a diversity of genes. Thus, deleterious genes become fixed in the population, and the diversity of different kinds of genes held by individuals as well

as among all individuals becomes reduced over time. This effect is called genetic drift. Small populations also suffer from higher chances of related individuals breeding, which again traps the more harmful recessive genes and reduces the diversity of all other genes; this is called inbreeding. The effect of inbreeding is the susceptibility to greater rates of mortality and reduced reproductive rates; these effects are called inbreeding depression. Inbreeding and inbreeding depression are more likely to occur in small populations that are reproductively isolated from other populations and therefore cannot tap into an outside, more diverse, gene pool. The degree to which a particular habitat management plan would cause isolation of small populations is thus important to its viability.

Individuals of a species select particular kinds of environments, habitats, and foods. This selection, in turn, affects how vulnerable the species is to changes in particular conditions. For example, a generalist species that occupies many kinds of forest age classes, or that can use a wide variety of food items, might be far less affected by changes in one forest age class or availability of one prey item than would a specialist species that depends on that particular habitat or food for its survival. Similarly, a species capable of wide dispersal and movement across broad landscape areas, and which is not particularly susceptible to starvation or predation during such movements, is more likely to persist in well distributed patterns than would a species with lower dispersal capabilities or one that is susceptible to substantial rates of starvation or predation during dispersal.

**Factors External to the Population:**

- systematic and catastrophic losses of habitats
- changes in distributional patterns of habitats
- other species
- disease, pathogens, and environmental contaminants

**Habitat Loss.** Habitat loss is often the primary cause of short-term declines in wildlife populations. Habitat can be lost or changed to less suitable conditions at a systematic rate, such as with urbanization, agriculture, and commercial forestry. Habitat can also be changed at a more acute rate such as catastrophic loss from major wind or ice storms that damage or destroy large forest areas, volcanoes, floods, and other cataclysmic events. Ideally, to predict effects of catastrophes, scientists would need to know the location, extent, effects, frequency, and duration of such past events. However, this information is not available for most types of catastrophic events affecting habitats of the northern spotted owl.

**Habitat Patterns.** Effects of changes in distributional patterns of habitat cover types frequently are difficult to describe and predict. Changes in habitat patterns include potential effects of habitat fragmentation, such as the breaking up of extensive areas of mature and old-growth forests into smaller, more isolated patches.

**Other Species.** Interactions with other species can influence the presence and viability of a wildlife population in several ways. Competitors can exclude the species from an area and prevent it from feeding or breeding. Closely related species can hybridize with the species and swamp its genetic identity. Predators can attack young, preventing successful dispersal and colonization of habitats. All of these factors affect viability and persistence of a species if they occur at rates great enough to influence reproduction, survival, or movement patterns.

**Disease, etc.** Pathogens, parasites, disease organisms, and presence of environmental contaminants can reduce the vitality and reproductive capability of individuals and even cause direct mortality. Factors acting in combination may have more significant effect than any one factor acting alone. As with other factors, their effect on population persistence is a function of their severity and prevalence.

## **Factors Influenced by Implementing Standards and Guidelines**

This document presents an analysis of potential environmental impacts from implementing proposed spotted owl habitat management alternatives. Each alternative, however, focuses on maintaining certain amounts and distribution patterns of habitat conditions for northern spotted owls on National Forests. The alternatives do not call for direct manipulation of population demographic or genetic conditions, prey abundance, occurrence of other species, or other factors external to forest habitat. Thus, all of these other factors are assumed to be affected, directly or indirectly, by the kinds, amounts, and locations of forest habitats provided.

The kinds, amounts, and locations of habitats provided by the alternatives directly affect the size and distribution of associated populations of northern spotted owls.

## **Population Size in Relation to Amount and Distribution of Habitat**

Results of field investigations (summarized in Thomas et al. 1990: Appendix H) indicate two general relationships between spotted owl populations and amount of nesting, roosting, and foraging habitat (referred to as "habitat" in this section unless otherwise noted).

First, northern spotted owls are more likely to occupy specific sites when those sites have a greater percentage of habitat. For example, the ISC Report stated, based on analyses of randomly sampled areas of 1,000 acres, that the percentage of occupancy was higher in randomly sampled areas with greater than 500 acres of habitat than in randomly sampled areas with less than 500 acres of habitat (Thomas et al 1990: 188). Similarly, percentage occupancy by spotted owls increased significantly with increasing amounts of habitat.

Secondly, density or number of breeding pairs per 100 square miles increased as percentage of habitat increased. Bart and Forsman (unpublished, cited in Thomas et al. 1990: 190) summarized existing

data on spotted owl density in more than 40 large areas (mean size of 59 square miles) in relation to the amount of habitat (forests greater than 160 years old) distributed throughout Washington, Oregon and California. The ISC Report aggregated these data into seven geographic regions and reported an increase in mean density of owls proportional to an increase in habitat within each province (Thomas et al. 1990: 190).

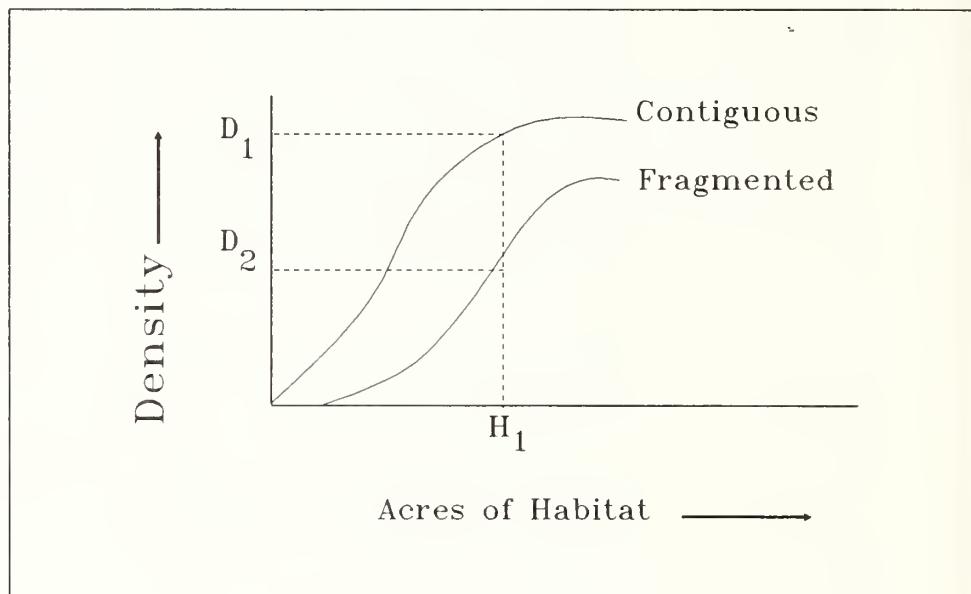
The Interagency Scientific Committee concluded that, although none of the studies they reviewed would, considered alone: “provide a strong basis for evaluating the relation between the amount of old-growth forest in a given landscape and the relative abundance of spotted owls there, coincidence is unlikely to account for the general pattern” (Thomas et al. 1990: 191). They further conclude that “removal of old-growth forests generally result in a decrease in abundance of spotted owls. We know of no study that has reached an opposite conclusion.”

The relationship between numbers of spotted owls and amount of habitat might also be influenced by the pattern of that habitat on the landscape. Habitat distributed as small, fragmented patches probably supports fewer pairs of owls or pairs that are less reproductively successful than the same total amount of unfragmented habitat (Figure 3&4 – 6). The quantitative relationship between degree of habitat fragmentation and abundance of spotted owls has not been clearly demonstrated, therefore the pattern illustrated in Figure 3&4 – 6 is simply a qualitative example.

## The Affected Environment and Environmental Consequences

### Figure 3&4 – 6 Abundance of Owls in Relation to Habitat

Hypothetical relationship between amount of habitat and density (numbers/unit area) of spotted owls in fragmented and contiguous habitat. For a given amount of habitat ( $H_1$ ), density will be greater if that habitat is contiguous ( $D_1$ ), than if it is fragmented ( $D_2$ ). A similar relationship might occur with reproductive rate.



### Parameters Used to Assess Viability

The viability assessment relates to the intrinsic and extrinsic factors that influence the population through time. Intrinsic factors are influences that are inherent to the species such as the demographic and genetic factors. Extrinsic factors are influences external to the species such as amount and distribution of habitat, competition, predation and catastrophic events.

The population conditions, such as size and distribution, can be indexed by a variety of parameters that can be directly measured. These measurements are chosen to provide an assessment of the effects of habitat management on population viability. Population viability is directly influenced by habitat amount and distribution.

The following biologically-based parameters affect viability. However, the criteria will, by necessity, be based on indices that are directly measurable. A brief discussion of the parameters which are indexed by the seven criteria used to assess viability are discussed below.

Parameters that influence population viability:

**Population Structure:**

Population structure is defined as the number of animals in different age and sex classes. Population structure is influenced by stage-specific vital rates of the population and their associated variance, including birth and death rates, and age and sex ratios.

**Population Size:**

- Total adult population size
- Effective population size. The effective population size is the number of males and females of a population that interbreeds.

**Population Distribution:**

- Regional or range-wide scale, that is the range of the subspecies on National Forests
- Physiographic province scale, that is at the population level
- Local scale, that is within and among clusters of pairs

**Population Trend:**

Genetic diversity, catastrophes, and interactions with other species are not included specifically here as parameters analyzed in this viability analysis, because of limited or unavailable data. Catastrophes and species interactions were considered as part of population distribution.

## Importance of Scale in Assessing Population Distribution

It is necessary to examine the issue of population viability at a variety of scales. The population of a species can be viewed as being comprised of a number of components, all of which must be sufficient to ensure a self-sustaining, well distributed viable population over the long term. Three scales that should be considered are:

**Subspecies' Range.** The first scale that needs to be addressed is the range-wide distribution of a species or subspecies. The primary objective is to ensure that a species will be well distributed throughout at least its range. The overall amount and distribution of habitat should be adequate to ensure that population sizes are large enough in turn to ensure protection against random changes in environmental conditions and birth and death rates. Management at this scale should ensure that successful dispersal and movement of juveniles and adults can occur throughout the range.

**Physiographic Provinces.** Within the range, there are a number of physiographic provinces, or combinations of physiographic provinces. Management concerns at this scale include ensuring that there are sufficient numbers of breeding pairs that can freely interact to guard against the negative effects of potential demographic or genetic problems.

## *The Affected Environment and Environmental Consequences*

At this scale, the amount and spacing of habitat must be sufficient to ensure that individuals can interact throughout each population and can occupy habitats over time. As animals die, vacant sites must be reoccupied by other individuals. Unoccupied suitable sites might be recolonized by northern spotted owls if the sites are spaced reasonably close together, and if the intervening lands allow for reasonable chances of successful dispersal between sites. If sites are spaced too far apart, or if adequate dispersal habitat is not provided between sites, the sites will remain unoccupied more often than not. This will eventually cause population sizes to decline.

**Local Scale.** This scale can be equated to clusters of pairs that can freely interact and be self-perpetuating at least on the short term. A cluster of pairs is likely to be susceptible to catastrophic loss. At this scale, a management concern is to provide for the dispersal needs of the subspecies, through ensuring connectivity among designated areas. Habitat should be provided in a pattern that will facilitate dispersal, and allow for pairs to interact. The management objective at this scale is to provide for clusters of pairs by providing habitat in such a configuration that breeding pairs can freely interact and are not isolated.

At this scale, the amount and arrangement of habitat must be adequate to support breeding animals, such as reproductive pairs of spotted owls. There should be sufficient habitat to provide cover from predators and adverse weather, adequate amounts of prey, and nesting and roosting substrates. If habitats are inadequate in cover type, amount, or distribution, the likelihood that the site will support breeding individuals over time declines. If this occurs in a large enough area, overall population size and viability will decline.

## Criteria Used to Assess Viability

The viability analysis used to assess population viability and to array the management alternatives for spotted owl habitat is based on seven criteria that were chosen to index specific population parameters at the various scales. The parameter of population structure was not directly indexed because data are limited or unavailable precluding quantification of this parameter for each alternative through time.

None of the criteria can be used independently to assess population viability. The inter-relationships among all criteria must be considered when assessing population viability. It is possible that an alternative could be weak in one criterion but be strong in a compensating criterion which must be considered in developing the overall rating for an alternative.

**Criterion 1: Potential Change.** Potential change in amount, and rate of change, of spotted owl nesting, roosting, and foraging habitat over time on National Forests.

Parameter: Population trend, in the short and long term, at the subspecies' range and physiographic province scales.

The intent of this criterion is to assess affects of each alternative on the amount of spotted owl habitat over time. An increase in the amount of habitat provides a higher probability of persistence for the spotted owl than a decrease in habitat. A stable or slow rate of decline in amount of habitat offers lower likelihood of persistence, but allows managers more time to detect, and possibly correct, unacceptable declines in spotted owl populations caused by loss of habitat. A more rapid rate of decline may preclude effective intervention by managers.

**Criterion 2. Distribution.** Provision on National Forests for designated spotted owl nesting, roosting, and foraging habitat distributed throughout the range of the northern spotted owl, with emphasis on areas of concern.

Parameter: Population distribution at the subspecies' range and physiographic province scaled.

The basic premise for this criterion is that species or subspecies well distributed throughout their ranges are less prone to extinction than those species confined to small portions of their range.

Other elements being equal, a broadly distributed population with few barriers to movement has a higher probability of viability than a subdivided population with more barriers within its range (Thomas et al. 1990: 23). A broad, interconnected distribution lessens risk of catastrophic loss due to disease, habitat destruction, and other catastrophic events. Areas of concern are identified in the ISC Report (Thomas et al. 1990: 66); USDA 1988b: Vol. I, Summary-32; Anderson et al. (1990) and 56 FR 40007. Several areas of concern have been

## *The Affected Environment and Environmental Consequences*

identified because, as a result of natural and human-caused activities, they have low amounts of spotted owl habitat or they may be isolated, or both. Thus, problems with distribution may occur in these areas and protection of habitat is therefore especially important.

**Criterion 3: Habitat Capability.** Habitat capability, estimated as potential number of pairs of northern spotted owls, within each population over time on National Forests.

Parameter: Population size at the physiographic province scale.

The basic premise of this criterion is that a higher habitat capability is better because of the greater likelihood for sufficient population size to offset potential demographic or genetic problems.

The intent of this criterion is to evaluate habitat capability of large areas supporting interbreeding owls. The values used to assess this criterion are based on estimates from Schonewald-Cox (1983) as adapted by Marcot et al. (1986). Schonewald-Cox described nine levels of protection ranging from low likelihood of long-term survival to very high likelihood. The number of reproductive pairs are assumed to approximately equal effective population size (that is, the effective population size is approximately one-half the adult census population size) (Marcot and Holthausen 1987).

For the purposes of this analysis, habitat capability was estimated using home range size as a function of percent habitat within the home range, with correction for overlap and occupancy rates. Methods are fully described in Appendix B.

**Criterion 4: Dispersal Habitat.** Provision for movement or dispersal habitat in National Forests outside of designated areas managed primarily for spotted owl habitat.

Parameter: Distribution among clusters at the local scale.

The basic premise of this criterion is that providing habitat between designated areas facilitates the movement and dispersal of owls among clusters.

A thorough discussion of dispersal habitat was presented in the ISC Report (Thomas et al. 1990: 309-310). In summary, the report states, "We use 'connectivity' to mean the kinds and amounts of habitat occurring in the zones between [designated areas]. Conditions there must be compatible with the movement of spotted owls, such that they are both capable of moving through these habitats and inclined to do so. Although connecting zones need not assure habitat capable of supporting a pair of breeding owls, they do need to provide stopover places where owls can find suitable cover and, especially, foraging opportunities. To that extent, then, we believe that the

connecting zones between [designated areas] must include some forested landscapes.” Several areas of concern have been identified because they pose barriers to movement and dispersal of spotted owls. Provisions for dispersal habitat in these areas is especially important.

**Criterion 5: Spacing.** Spacing between designated areas managed primarily for owl habitat, measured between boundaries of designated areas on National Forests.

Parameter: Population distribution among pairs at the local scale.

The basic premise of this criterion is that designated areas closer together provide greater assurance of successful movement of spotted owls among areas than when such areas are farther apart.

The basis for assessing this criterion is the data set reported in the ISC Report (Thomas et al. 1990: 307) which states 67 percent of all juveniles observed dispersed maximum distances of 12 miles or more, and 50 percent dispersed at least 17.5 miles. When designated areas are further than 17 miles apart, there is a greater risk of mortality or lower probability of locating a mate.

To provide for viable populations, habitats need to be both well distributed and spaced close enough to ensure interchange of spotted owls among designated habitats. Spacing and distribution are related. A habitat conservation strategy has a greater likelihood of success if it provides adequate access among several designated areas. This redundancy in distribution is insurance against severing populations if designated habitat areas are changed to unsuitable conditions due to catastrophic events. Measurements of first, second, and third nearest distances from each designated habitat area provides an estimate of such spacing patterns.

**Criterion 6: Patch Size.** Provision for size and distribution of spotted owl nesting, roosting, and foraging habitat patches within designated areas managed primarily for owl habitat on National Forests.

Parameter: Population size and population distribution within clusters at the local scale.

The intent of this criterion is to assess patch size and patch contiguity as two measures of habitat quality. The premise is that larger, more contiguous habitat patches are of higher quality than small non-contiguous habitat. Northern spotted owls are more likely to persist in higher quality habitat than in lower quality habitat. Smaller patches, especially those with abrupt edges, may also result in habitat loss when exposed trees fall in high winds and when stands suffer other impacts associated with forest edges (Thomas et al. 1990). As patches of habitat become smaller and more isolated, habitat quality decreases. Likelihood of future occupancy by spotted owls is higher if currently

## *The Affected Environment and Environmental Consequences*

poor quality habitat is managed to assure recovery of previously harvested areas to regain spotted owl nesting, roosting, and foraging habitat characteristics in large contiguous blocks.

**Criterion 7: Clustering.** Provision for designated areas large enough to support multiple pairs of spotted owls on National Forests.

Parameters: Trend in population size at the local scale.

The basic premise of this criterion is that large designated areas containing multiple pairs of owls, referred to as clusters of pairs, provide for greater likelihood of persistence of owls than do small designated areas.

Demographic modeling conducted by the Interagency Scientific Committee (Thomas et al. 1990) suggested that clusters of more than 20 owl pairs were more likely to persist because of, among other factors, increased probability of within-cluster replacement of lost mates by nonterritorial birds. The ISC Report (Thomas et al. 1990: 24) noted, “both empirical and modeling results suggest that clusters of 15 to 20 pairs should be stable over the long-term, even given low to moderate rates of dispersal among them by juvenile owls.” The Interagency Scientific Committee recommended 20-pair clusters because not all pair sites were expected to be occupied at any one point in time.

Because not all areas are capable of supporting large, protected clusters of owls due to existing habitat conditions and ownerships, it is not possible to specify absolute numbers of individual pairs or clusters as a basis for assessing alternatives. Rather, assessments are based on frequency distribution of cluster sizes.

## Assessing the Alternatives

---

### Assumptions

The Forest Service manages 75 percent of the remaining northern spotted owl nesting, roosting, and foraging habitat. The alternatives provide management direction for National Forests only. To assess viability across the owl's range it is assumed that other land managers will manage their lands in accordance with the Endangered Species Act. Specifically, it is assumed that as a result of consultation with U.S. Fish and Wildlife Service, under Section 7(a) of the Endangered Species Act, other Federal agencies will manage their lands with a level of spotted owl habitat protection similar to that of the ISC Strategy. This assumption is particularly important in assessing viability of the northern spotted owl in southwest Oregon where the Siuslaw National Forest is isolated from other National Forests and connectivity is at least partially dependent on BLM lands.

As a result of receiving "jeopardy opinions" on 44 proposed timber sales, the Bureau of Land Management applied on September 11, 1991 for an exemption from the requirements of the Endangered Species Act under Section 7(g). If the Endangered Species Committee grants an exemption to the BLM, and spotted owl habitat on the lands BLM manages is adversely modified, this viability rating would be optimistically high at least for southwest Oregon and the Oregon Coast Range populations.

Additionally, in their Biological Opinion on the Draft Environmental Impact Statement (see Appendix M) the U.S. Fish and Wildlife Service stated that if BLM were granted exemption from Section 7(a) of the Endangered Species Act they would consider this significant new information. U.S. Fish and Wildlife Service further stated, "Under that circumstance, the Service and the Forest Service must consider the need for reinitiation of this consultation."

This viability assessment uses data based on land allocations in Final Forest Plans in Oregon and Washington, and current forest planning information in California. This current forest planning information in California shows less land available for timber production than when the ISC Strategy was developed. Alternatives B, C, D, and E reflect information developed over the last 2 years primarily on maintenance of sensitive furbearer habitat. This new information is included in the analysis for this environmental impact statement. If completion of Final Forest Plans in California results in changes in the amount, distribution, or capability of spotted owl habitat, or if changes are made in land allocations from Forest Plans in Oregon and Washington, this viability assessment might need to be reevaluated.

This viability assessment assumes that management of State and private lands in northern California will be carried out under the leadership of the State, with cooperation of private landowners, to provide for a level of spotted owl protection that will ensure there is not adverse effect to

## *The Affected Environment and Environmental Consequences*

the continued existence of the subspecies in northern California. This would be accomplished through California's Habitat Conservation Plan for the Northern Spotted Owl currently in preparation (Matroni Per. comm.).

Several assumptions were made about how standards and guidelines for Alternative E would be implemented to facilitate assessment of owl viability for the alternative. If the actual implementation of these standards and guidelines does not conform to these assumptions, the viability assessment for the northern spotted owl might need to be reevaluated.

Key assumptions for assessing Alternative E are:

- The number and location of Research Multiple-Pair Areas will remain as currently mapped.
- The area in nesting, roosting, and foraging habitat within Research Multiple-Pair Areas will not decrease more than 20 percent from amounts of habitat that would occur if the entire area were deferred from timber harvest beginning from the present.
- Standards and guidelines state a range of 30 to 50 percent nesting, roosting, and foraging habitat per watershed. It was assumed connecting habitat would average 40 percent nesting, roosting, and foraging habitat on each National Forest.
- No timber harvest is scheduled in Deferred Multiple-Pair Areas during the 150-year time period assessed. This assumption is more stringent than standards and guidelines which state timber harvest is "temporarily precluded."

For predictions of amount of habitat (criterion 1) and future habitat capability (criterion 3), it was assumed that the quality of northern spotted owl habitat (that habitat affording life needs of reproductive pairs) is the same for areas inside and outside Wilderness, existing old-growth forests, and for young-growth forests that reach a minimum age to qualify as spotted owl habitat. However, spotted owl habitat in most Wilderness is generally not high quality habitat; reproductive success of spotted owls in Wilderness is only about half that of owls outside Wilderness (Bart and Forsman, in press). Additionally, existing old-growth forests provide superior habitat conditions, in contrast to young-growth forests that reach a minimum age to qualify as spotted owl habitat. Such differences in habitat quality were considered in a qualitative sense when the alternatives were rated as to the viability effects.

The Forest Service will consult with the U.S. Fish and Wildlife Service on any activities that may affect Critical Habitat as identified in the final rule of January 1992. This will occur under any of the alternatives. As a result of compliance with recommendations from consultation on Critical Habitat, there may be more habitat available for the northern spotted owl under Alternatives A, B, and E than displayed and analyzed in this viability assessment.

## Criterion 1 Potential Change

### Information Relative to All Alternatives

Potential change in amount and rate of change of spotted owl nesting, roosting, and foraging habitat, over time, on National Forests.

This criterion evaluates the change in amount of habitat over time, in addition to the rate of change in habitat for each of the alternatives. Changes in habitat were examined in three ways. First, total acres of owl habitat were estimated at four intervals: current time, 50 years from now, 100 years from now, and 150 years from now. Second, rates of change were calculated over three time increments spanning 0-50, 50-100, and 100-150 years. These time periods were considered most relevant in evaluating viability of the spotted owl, a long-lived species with an average generation time of about 10 years. Because viability is best assessed over multiple generations, periods of 50 years (about five generations) were considered most appropriate. Finally, the amount of habitat at year 150 was compared to the current amount. A comparison of the alternatives for Criterion 1 is presented in Table 3&4 – 11, and in Figure 3&4 – 7.

Ingrowth of habitat is predicted for two categories of lands: those unavailable for timber production including designated areas managed primarily for owl habitat, reserved areas and other lands unsuitable for timber production; and those lands suitable for timber production. Forest stands within designated areas that are not currently considered spotted owl habitat are predicted to become nesting, roosting, and foraging habitat over time, as are a portion of the other lands that are unavailable for timber production. Additionally, due to long rotations and specific timber harvest prescriptions for considerations such as wildlife and visual retention areas, some lands considered suitable for timber production will develop the structure of nesting, roosting, and foraging habitat.

Future nesting, roosting, and foraging habitat, especially on lands suitable for timber production, may not satisfy life requirements of the northern spotted owl to the same degree as late-successional forests, especially old-growth forests. Most of the existing high quality habitat on suitable timber lands will have been harvested and habitat that is grown from managed stands will include a large proportion of young-growth forests that have recently reached minimum age to qualify as spotted owl habitat. Habitat in designated areas is expected to be higher quality in the future.

Standards and guidelines for the Forest Matrix in Alternatives B, C, and D, and in Research MPAs for Alternative E, encourage experimentation with different silvicultural practices. The objectives of the silvicultural prescriptions include maintaining, creating, or accelerating growth of spotted owl nesting, roosting, and foraging habitat. Because it has not been proven that silvicultural manipulation of stands can create spotted owl habitat, no additional growth of habitat was assumed.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 6 Potential Change in Owl Habitat, Alternative A**

Potential change in amount, and rate of change, of spotted owl nesting, roosting, and foraging habitat in acres, over time, on National Forests for Alternative A.<sup>1</sup>

Physiographic Province							
Year	Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	Total	
0	Desig Total <sup>2</sup>	81,000	382,000	304,000	52,000	476,000	1,294,000
	Owl Habitat <sup>3</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
	Suit TM <sup>4</sup>	101,000	621,000	1,053,000	132,000	478,000	2,384,000
	Unavail <sup>5</sup>	83,000	893,000	873,000	66,000	835,000	2,801,000
	Desig area <sup>6</sup>	76,000	279,000	230,000	46,000	260,000	890,000
50	Annual % <sup>7</sup> owl habitat	-0.56 187,000	-0.49 1,352,000	-0.63 1,507,000	-1.19 99,000	0.08 1,638,000	-0.42 4,783,000
100	Annual % owl habitat	-0.10 174,000	-0.01 1,340,000	-0.18 1,313,000	0.07 108,000	0.09 1,710,000	-0.05 4,645,000
150	Annual % owl habitat	0.02 176,000	0.10 1,428,000	0.14 1,469,000	-0.03 104,000	0.31 1,953,000	0.16 5,131,000

<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Desig total = Total acres of designated areas managed primarily for spotted owl habitat, and areas which currently are nesting, roosting, and foraging habitat, including other areas which currently are not owl habitat.

<sup>3</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat (acres) on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing at the current time and predicted for the future.

<sup>4</sup> Suit TM = Spotted owl nesting, roosting, and foraging habitat on all lands classified as suitable and available for timber production.

<sup>5</sup> Unavail = Spotted owl nesting, roosting, and foraging habitat on lands unavailable for timber production, including lands reserved at Chief's authority or higher, plus other lands classified as unsuitable for timber production, outside of designated areas.

<sup>6</sup> Desig Area = Spotted owl nesting, roosting, and foraging habitat in designated areas managed primarily for spotted owl habitat.

<sup>7</sup> Annual % = Average annual percent change for previous 50-year increments, expressed as percent of current amount of habitat.

**Criterion 1**  
**Potential**  
**Change**  
**Alternative A**

**Alternative A.** For this alternative, 890,000 acres of spotted owl nesting, roosting, and foraging habitat are within designated areas managed primarily for owl habitat (Table 3&4 – 6). For Alternative A, there is a predicted net decrease of more than 1 million acres of spotted owl nesting, roosting, or foraging habitat over the next 50 years, with an overall net decrease in habitat of 942,000 acres by year 150.

The net rate of decrease is greatest in the first 50-year period. The rate of decrease is 0.42 percent per year, averaging about 25,800 acres per year for the first 50-year period.

Habitat decline continues at a slower rate for the second 50-year period, with a rate of loss of 0.05 percent per year, averaging about 3,000 acres per year. This results in an overall decrease of approximately 1.4 million acres from current figures.

There is a predicted net increase in habitat from year 100 to year 150 at a rate of 0.16 percent per year.

The Olympic Peninsula and Oregon Coast Range Provinces will become increasingly isolated from spotted owl populations in other provinces. Reduction of the total habitat within these physiographic provinces on National Forests under this alternative will result in substantial risk to viability.

The Washington Cascades, the Oregon Cascades and Klamath Provinces follow the general patterns described for the total area.

In Oregon and Washington, SOHAs are not mapped specifically in Wilderness areas though these areas are expected to contribute to the network of spotted owl habitat. In California some SOHAs are mapped in Wilderness areas.

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 7 Potential Change in Owl Habitat, Alternative B**

Potential change in amount, and rate of change, of spotted owl nesting, roosting and foraging habitat, over time, on National Forests for Alternative B.<sup>1</sup> (in acres)

Physiographic Province							
Year		Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	Total
0	Desig total <sup>2</sup>	441,000	1,870,000	1,437,000	294,000	1,859,000	5,901,000
	Owl habitat <sup>3</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
	Suit TM <sup>4</sup>	28,000	282,000	771,000	65,000	434,000	1,579,000
	Unavail <sup>5</sup>	12,000	579,000	622,000	32,000	464,000	1,131,000
	Desig area <sup>6</sup>	219,000	931,000	813,000	146,000	676,000	2,785,000
50	Annual % <sup>7</sup> owl habitat	0.12 274,000	-0.10 1,706,000	-0.43 1,728,000	-0.30 207,000	0.15 1,690,000	-0.15 5,605,000
100	Annual % owl habitat	0.27 309,000	0.18 1,869,000	0.03 1,763,000	0.31 245,000	0.19 1,840,000	0.14 6,025,000
150	Annual % owl habitat	0.29 347,000	0.20 2,051,000	0.20 1,979,000	0.35 288,000	0.35 2,116,000	0.25 6,781,000

<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Desig total = Total acres of designated areas managed primarily for spotted owl habitat, and areas which currently are nesting, roosting, and foraging habitat, including other areas which currently are not owl habitat.

<sup>3</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat (acres) on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing at the current time and predicted for the future.

<sup>4</sup> Suit TM = Spotted owl nesting, roosting, and foraging habitat on all lands classified as suitable and available for timber production.

<sup>5</sup> Unavail = Spotted owl nesting, roosting, and foraging habitat on lands unavailable for timber production, including lands reserved at Chief's authority or higher, plus other lands classified as unsuitable for timber production, outside of designated areas.

<sup>6</sup> Desig Area = Spotted owl nesting, roosting, and foraging habitat in designated areas managed primarily for spotted owl habitat.

<sup>7</sup> Annual % = Average annual percent change for previous 50-year increments, expressed as percent of current amount of habitat.

**Criterion 1  
Potential  
Change**

**Alternative B**

**Alternative B.** For this alternative, 2,785,000 acres of spotted owl nesting, roosting and foraging habitat is within designated areas managed primarily for spotted owl habitat (Table 3&4 – 7).

For Alternative B, there is a predicted net decrease of approximately 468,000 acres of spotted owl nesting, roosting, and foraging habitat over the first 50 years. However, there will be a predicted increase in habitat by year 150.

The rate of decrease is 0.15 percent per year, averaging about 9,000 acres of nesting, roosting, and foraging habitat per year for the first 50 years.

For the second and third 50-year periods, there is a net increase in the amount of habitat. For the second 50-year period the rate averages 0.14 percent per year, or an average increase of approximately 8,400 acres per year. The rate further increases to 0.25 percent per year for the third 50-year period, averaging approximately 15,000 acres per year.

In the Oregon Coast Range, Washington Cascades, and Oregon Cascades Provinces habitat declines during the first 50-year period. However, over the next two 50-year periods, habitat increases.

For the Olympic Peninsula and the Klamath Provinces, habitat increases over all time periods.

Overall, designated areas managed primarily for spotted owl habitat under Alternative B are approximately 23 percent Wilderness.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 8 Potential Change in Owl Habitat, Alternative C**

Potential change in amount, and rate of change, of spotted owl nesting, roosting and foraging habitat in acres, over time, on National Forests for Alternative C.<sup>1</sup>

Year		Physiographic Province					Total
		Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	
0	Desig total <sup>2</sup>	494,000	2,201,000	2,061,000	391,000	2,146,000	7,293,000
	Owl habitat <sup>3</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
	Suit TM <sup>4</sup>	13,000	211,000	590,000	41,000	384,000	1,240,000
	Unavail <sup>5</sup>	6,000	492,000	447,000	22,000	418,000	1,384,000
	Desig area <sup>6</sup>	239,000	1,089,000	1,170,000	181,000	771,000	3,450,000
50	Annual % <sup>7</sup> owl habitat	0.31 299,000	-0.06 1,739,000	-0.06 2,136,000	0.43 295,000	0.17 1,703,000	0.03 6,171,000
100	Annual % owl habitat	0.34 343,000	0.14 1,861,000	0.11 2,257,000	0.44 349,000	0.20 1,864,000	0.17 6,673,000
150	Annual % owl habitat	0.35 388,000	0.15 1,998,000	0.16 2,431,000	0.44 402,000	0.27 2,078,000	0.21 7,297,000

<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Desig total = Total acres of designated areas managed primarily for spotted owl habitat, and areas which currently are nesting, roosting, and foraging habitat, including other areas which currently are not owl habitat.

<sup>3</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat (acres) on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing at the current time and predicted for the future.

<sup>4</sup> Suit TM = Spotted owl nesting, roosting, and foraging habitat on all lands classified as suitable and available for timber production.

<sup>5</sup> Unavail = Spotted owl nesting, roosting, and foraging habitat on lands unavailable for timber production, including lands reserved at Chief's authority or higher, plus other lands classified as unsuitable for timber production, outside of designated areas.

<sup>6</sup> Desig Area = Spotted owl nesting, roosting, and foraging habitat in designated areas managed primarily for spotted owl habitat.

<sup>7</sup> Annual % = Average annual percent change for previous 50-year increments, expressed as percent of current amount of habitat.

**Criterion 1  
Potential  
Change**

**Alternative C**

**Alternative C.** For this alternative, there are 3,450,000 acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat (Table 3&4 – 8).

For Alternative C, there is a predicted slight net increase of spotted owl nesting, roosting, and foraging habitat over the next 50 years, with an overall net increase of habitat of about 1.2 million acres by year 150.

The net annual rate of increase is 0.03 percent, or approximately 2,000 acres per year for the first 50 years. The rate increases to 0.17 percent per year, or about 10,000 acres, for the next 50 years. The rate further increases to 0.21 percent per year, or 12,500 acres, for the next 50 years.

For the Olympic Peninsula and Oregon Coast Range Provinces, acres of spotted owl habitat increase over all time periods, a trend that will improve the likelihood of viability of these isolated populations of spotted owls.

The Oregon Cascades and Washington Cascades Provinces are predicted to have a decline of 0.06 percent per year for the first 50-year period followed by successive periods of increase. Habitat on all other provinces increases over all time periods.

Overall, designated areas managed primarily for owl habitat under Alternative C are approximately 19 percent Wilderness.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 9 Potential Change in Owl Habitat, Alternative D**

Potential change in amount, and rate of change, of spotted owl nesting, roosting, and foraging habitat in acres, over time, on National Forests for Alternative D.<sup>1</sup>

		Physiographic Province					
Year		Olympic Peninsula	Washington Cascades	Oregon Cascades	Oregon Coast Range	Klamath	Total
0	Desig total <sup>2</sup>	481,000	2,731,000	2,830,000	391,000	2,756,000	9,190,000
	Owl habitat <sup>3</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
	Suit TM <sup>4</sup>	0	0	0	0	0	0
	Unavail <sup>5</sup>	0	0	0	0	0	0
	Desig area <sup>6</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
50	Annual % <sup>7</sup> owl habitat	0.29 296,000	0.21 1,977,000	0.17 2,391,000	0.31 281,000	0.55 2,005,000	0.29 6,951,000
100	Annual % owl habitat	0.29 334,000	0.21 2,161,000	0.17 2,576,000	0.32 320,000	0.31 2,249,000	0.23 7,640,000
150	Annual % owl habitat	0.29 371,000	0.21 2,346,000	0.17 2,761,000	0.31 358,000	0.38 2,545,000	0.24 8,381,000

<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Desig total = Total acres of designated areas managed primarily for spotted owl habitat, and areas which currently are nesting, roosting, and foraging habitat, including other areas which currently are not owl habitat.

<sup>3</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat (acres) on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing at the current time and predicted for the future.

<sup>4</sup> Suit TM = Spotted owl nesting, roosting, and foraging habitat on all lands classified as suitable and available for timber production. This is zero for Alternative D since all nesting, roosting, and foraging habitat is in designated areas managed primarily for spotted owl habitat.

<sup>5</sup> Unavail = Spotted owl nesting, roosting, and foraging habitat on lands unavailable for timber production, including lands reserved at Chief's authority or higher, plus other lands classified as unsuitable for timber production, outside of designated areas. This is zero for Alternative D since all nesting, roosting, and foraging habitat is in designated areas managed primarily for spotted owl habitat.

<sup>6</sup> Desig Area = Spotted owl nesting, roosting, and foraging habitat in designated areas managed primarily for spotted owl habitat.

<sup>7</sup> Annual % = Average annual percent change for previous 50-year increments, expressed as percent of current amount of habitat.

**Criterion 1  
Potential  
Change  
Alternative D**

**Alternative D.** For this alternative, 6,073,000 acres of nesting, roosting, and foraging habitat are within designated areas managed primarily for owl habitat (Table 3&4 – 9).

For Alternative D, there is a predicted net increase of 878,000 acres of spotted owl nesting, roosting, and foraging habitat to year 50, with an overall net increase of 2.3 million acres by year 150.

The net rate of increase remains high for all physiographic provinces for all time periods. Relative to other provinces, the net annual rate of increase of habitat is greatest on the Klamath Province and the Oregon Coast Range Province. The Coast Range is an area of concern because of its relative isolation and fragmented habitat.

Overall, designated areas managed primarily for spotted owl habitat under Alternative D are approximately 21 percent Wilderness.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 10 Potential Change in Owl Habitat, Alternative E**

Potential change in amount, and rate of change, of spotted owl nesting, roosting, and foraging habitat in acres, over time, on National Forests for Alternative E.<sup>1</sup>

		Physiographic Province					
Year		Olympic Peninsula	Washington Cascades	Oregon Cascades	Oregon Coast Range	Klamath	Total
0	Desig total <sup>2</sup>	88,000	1,337,000	1,015,000	103,000	691,000	3,234,000
	Owl habitat <sup>3</sup>	259,000	1,792,000	2,206,000	243,000	1,573,000	6,073,000
	Suit TM <sup>4</sup>	104,000	442,000	944,000	107,000	478,000	2,075,000
	Unavail <sup>5</sup>	121,000	608,000	653,000	77,000	801,000	2,261,000
	Desig area <sup>6</sup> (include Res MPA) <sup>7</sup>	33,000 (0)	742,000 (273,000)	609,000 (129,000)	59,000 (49,000)	294,000 (77,000)	1,737,000 (528,000)
50	Annual % <sup>8</sup> owl habitat	-0.58 184,000	-0.32 1,505,000	-0.58 1,563,000	-0.46 132,000	0.09 1,644,000	-0.34 5,029,000
100	Annual % owl habitat	-0.11 170,000	0.08 1,575,000	-0.08 1,476,000	0.09 143,000	0.12 1,738,000	0.02 5,102,000
150	Annual % owl habitat	0.02 172,000	0.13 1,690,000	0.16 1,651,000	0.11 156,000	0.32 1,987,000	0.18 5,656,000

<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Desig total = Total acres of designated areas managed primarily for spotted owl habitat, and research areas, including areas which currently are nesting, roosting, and foraging habitat and including other areas which currently are not owl habitat.

<sup>3</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat (acres) on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing at the current time and predicted for the future.

<sup>4</sup> Suit TM = Spotted owl nesting, roosting, and foraging habitat on all lands classified as suitable and available for timber production, including connecting habitat with harvest constraints.

<sup>5</sup> Unavail = Spotted owl nesting, roosting, and foraging habitat on lands unavailable for timber production, including lands reserved at Chief's authority or higher, plus other lands classified as unsuitable for timber production, outside of designated areas.

<sup>6</sup> Desig area = Spotted owl nesting, roosting, and foraging habitat in designated areas managed primarily for spotted owl habitat, includes Reserved, Deferred and Research MPAs.

<sup>7</sup> Res. MPA = Research MPAs. Harvest permitted to decrease nesting, roosting, and foraging habitat up to 20 percent from amounts that would occur if area were a Deferred MPA.

<sup>8</sup> Annual % = Average annual percent change for previous 50-year increments, expressed as percent of current amount of habitat.

**Criterion 1  
Potential  
Change  
Alternative E**

**Alternative E.** For this alternative, 1,737,000 acres of nesting, roosting, and foraging habitat are within designated areas managed primarily for owl habitat (Table 3&4 – 10). This includes 528,000 acres within Research Multiple-Pair Areas that are subject to some alteration of habitat.

For Alternative E there is a predicted net decrease of approximately 1 million acres of nesting, roosting, and foraging habitat over the first 50 years. There will be a net overall decrease in habitat by year 150 of 417,000 acres.

The net rate of decrease is greatest in the first 50-year period. This rate is 0.34 percent per year, averaging 21,000 acres per year. There is a net increase in habitat from year 50 to year 150.

For the Olympic Peninsula and Oregon Coast Range Provinces nesting, roosting, and foraging habitat would be reduced by 87,000 acres per province over 150 years. Reduction of habitat to this degree in these physiographic provinces would result in a substantial risk to the viability of spotted owls.

Overall, designated areas managed primarily for spotted owl habitat under Alternative E are approximately 39 percent Wilderness. For the Olympic Peninsula Province, 100 percent of the designated area is in Wilderness, and in the Washington Cascades, 40 percent of the designated area is in Wilderness.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 11 Potential Change in Owl Habitat by Alternative, Criterion 1**

Change in amount of spotted owl habitat, rate of change of owl habitat, and percent of current spotted owl nesting, roosting, and foraging habitat, over time for each alternative on National Forests.<sup>1</sup>

Attribute	Alternative				
	A	B	C	D	E
Owl habitat <sup>2</sup> at year:	thousands of acres				
0	6,073	6,073	6,073	6,073	6,073
50	4,783	5,605	6,171	6,951	5,029
100	4,645	6,025	6,673	7,640	5,102
150	5,131	6,781	7,297	8,381	5,656
Annual % change <sup>3</sup> between year:	annual percentage				
0-50	-0.42	-0.15	0.03	0.29	-0.34
50-100	-0.05	0.14	0.17	0.23	0.02
100-150	0.16	0.25	0.21	0.24	0.18
Percent of current owl habitat at year 150:	84%	112%	128%	138%	93%

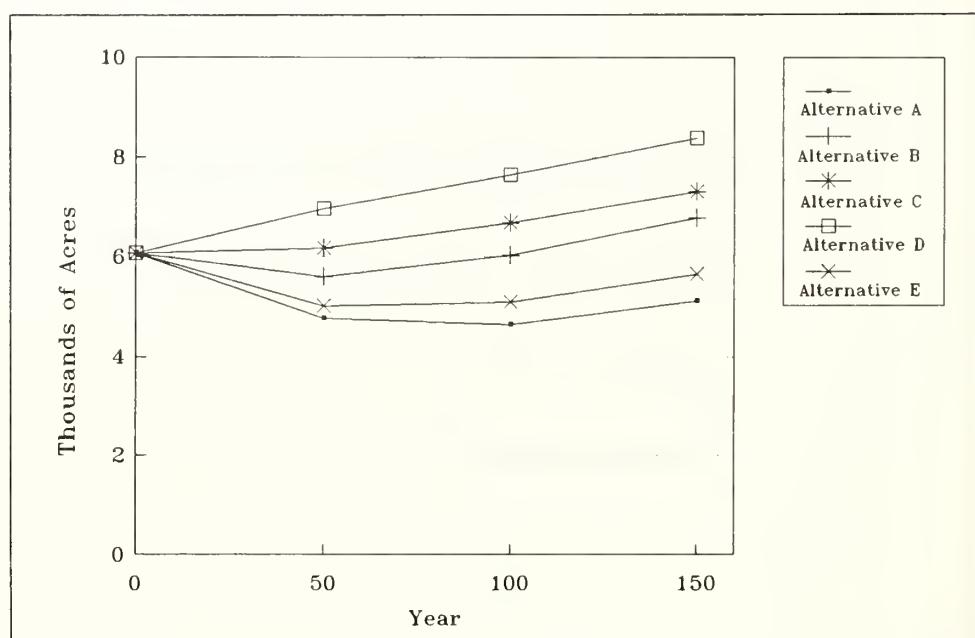
<sup>1</sup> Rounded to nearest thousand acres; therefore may not add to totals shown.

<sup>2</sup> Owl habitat = Amount of spotted owl nesting, roosting, and foraging habitat on all land classifications including designated lands, reserved lands, lands unsuitable for timber production and lands suitable for timber production, existing (current) and predicted for the future.

<sup>3</sup> Annual % = Average annual percent change for 50-year increments, expressed as percent of current amount of habitat.

**Figure 3&4 – 7 Owl Habitat Over Time by Alternative, Criterion 1**

Potential Change in amount of spotted owl nesting, roosting, and foraging habitat over time, for each alternative, on National Forests.



**Criterion 2:  
Distribution**

Provision on National Forests for designated spotted owl nesting, roosting, and foraging habitat distributed throughout the range of the northern spotted owl, with emphasis on areas of concern.

**Information  
Relative to All  
Alternatives**

The Forest Service administers only part of the lands in areas of concern and can only designate areas managed primarily for spotted owl habitat on lands it manages. Management of owl habitat on other lands influences habitat conditions within the areas of concern.

Lands managed by Bureau of Land Management provide dispersal and nesting, roosting, and foraging habitat in the I5/Klamath and Oregon Coast Range areas of concern. Any contributions of owl habitat on State and private lands in areas of concern would increase the likelihood of viability for the northern spotted owl, especially in southwest Washington, northwest Oregon, and northern California Coast Range.

## The Affected Environment and Environmental Consequences

### Criterion 2 Distribution Alternative A

**Alternative A.** The standards and guidelines for Alternative A specify that designated areas managed primarily for owl habitat should be distributed throughout the range of the spotted owl.

There is no specific emphasis on areas of concern. Approximately 1.6 million acres (65 percent) of nesting, roosting, and foraging habitat within areas of concern occur in designated areas and lands otherwise unavailable for timber production (Table 3&4 – 12, Figure 3&4 – 10). Under Alternative A, lack of designation of habitat in Olympic Peninsula and the Oregon Coast Range areas of concern would likely lead to local extinctions due to demographic isolation of owl populations. Spotted owl nesting, roosting, and foraging habitat in these areas in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber production is approximately 61 percent for the Olympic Peninsula area of concern and 46 percent for the Oregon Coast area of concern (Figures 3&4 – 8 and 9).

**Table 3&4 – 12 Areas of Concern, Alternative A**

Acres of National Forest and nesting, roosting, and foraging habitat in areas of concern<sup>1</sup>.

Alternative A	Area of Concern										Total
	Olympic Peninsula	North Cascades	Columbia Gorge	OR Coast Range	Santiam Pass	Klamath	Southern Deschutes	Shasta/ McCloud	Mendocino		
Total area of concern <sup>2</sup>	632,000	4,994,000	285,000	631,000	105,000	502,000	439,000	1,207,000	884,000	9,679,000	
Total owl habitat <sup>3</sup>	259,000	1,310,000	159,000	243,000	38,000	191,000	61,000	94,000	103,000	2,458,000	
Designated area <sup>4</sup>	81,000	262,000	40,000	52,000	3,000	46,000	9,000	52,000	60,000	605,000	
Owl habitats <sup>5</sup>	76,000	185,000	30,000	46,000	3,000	26,000	7,000	21,000	28,000	422,000	
Unavailable <sup>6</sup>	191,000	3,638,000	166,000	170,000	41,000	161,000	251,000	705,000	549,000	5,872,000	
Owl habitat <sup>7</sup>	83,000	762,000	89,000	66,000	15,000	51,000	18,000	51,000	39,000	1,174,000	

<sup>1</sup>Areas of concern, which include National Forests, as described in this chapter, see "Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat". North Cascades column includes North Cascades East and Highway I-90. Acres rounded to nearest thousand and therefore may not add to totals shown.

<sup>2</sup>Total acres of National Forest within each area of concern.

<sup>3</sup>Total acres of nesting, roosting, and foraging habitat within areas of concern.

<sup>4</sup>Total acres of designated areas managed primarily for spotted owl habitat within areas of concern.

<sup>5</sup>Acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat.

<sup>6</sup>Total acres of land unavailable for timber production within areas of concern, including lands reserved at Chief's authority or higher, and other lands classified as unsuitable for timber production and nonforested lands, outside designated areas.

<sup>7</sup>Acres of nesting, roosting, and foraging habitat on lands unavailable for timber production.

## Criterion 2 Distribution Alternative B

**Alternative B.** The standards and guidelines for Alternative B provide for Habitat Conservation Areas as designated areas managed primarily for spotted owl habitat throughout the range of the spotted owl. In addition, special emphasis was placed on locating designated areas in areas of concern. Over 2.0 million acres (83 percent) of nesting, roosting, and foraging habitat within areas of concern are in designated areas and lands otherwise unavailable for timber production (Table 3&4 – 13, Figure 3&4 – 10).

Because designated areas managed primarily for spotted owl habitat are placed in areas of concern, there is a substantially lower risk of localized extinction of spotted owls due to demographic isolation for the Olympic Peninsula and the Oregon Coast Range areas of concern than under Alternative A. Spotted owl nesting, roosting, and foraging habitat in these areas in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber production is approximately 89 percent on the Olympic Peninsula area of concern and 73 percent for the Oregon Coast Range area of concern (Figures 3&4 – 8 and 9).

**Table 3&4 – 13 Areas of Concern, Alternative B**

Acres of National Forest and nesting, roosting, and foraging habitat in areas of concern<sup>1</sup>.

Alternative B	Area of Concern									Total
	Olympic Peninsula	North Cascades	Columbia Gorge	OR Coast Range	Santiam Pass	Klamath	Southern Deschutes	Shasta/ McCloud	Mendocino	
Total area of concern <sup>2</sup>	632,000	4,994,000	285,000	631,000	105,000	502,000	439,000	1,207,000	884,000	9,679,000
Total owl habitat <sup>3</sup>	259,000	1,310,000	159,000	243,000	38,000	191,000	61,000	94,000	103,000	2,458,000
Designated area <sup>4</sup> Owl habitat <sup>5</sup>	441,000 219,000	1,391,000 679,000	227,000 132,000	293,000 146,000	36,000 18,000	181,000 77,000	46,000 19,000	256,000 61,000	268,000 64,000	3,139,000 1,415,000
Unavailable <sup>6</sup> Owl habitat <sup>7</sup>	31,000 12,000	2,914,000 472,000	31,000 15,000	96,000 32,000	30,000 9,000	94,000 30,000	242,000 15,000	522,000 16,000	433,000 15,000	4,393,000 616,000

<sup>1</sup>Areas of concern, which include National Forests, as described in this chapter, see "Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat". North Cascades column includes North Cascades East and Highway 1-90. Acres rounded to nearest thousand and therefore may not add to totals shown.

<sup>2</sup>Total acres of National Forest within each area of concern.

<sup>3</sup>Total acres of nesting, roosting, and foraging habitat within areas of concern.

<sup>4</sup>Total acres of designated areas managed primarily for spotted owl habitat within areas of concern.

<sup>5</sup>Acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat.

<sup>6</sup>Total acres of land unavailable for timber production within areas of concern, including lands reserved at Chief's authority or higher, and other lands classified as unsuitable for timber production and nonforested lands, outside designated areas.

<sup>7</sup>Acres of nesting, roosting, and foraging habitat on lands unavailable for timber production.

## The Affected Environment and Environmental Consequences

### Criterion 2 Distribution Alternative C

**Alternative C.** The standards and guidelines for Alternative C provide for HCAs and CHUs as designated areas managed primarily for spotted owl habitat throughout the range of the spotted owl. Additionally, special emphasis was placed on locating designated areas in areas of concern; thus, more land was designated in areas of concern than was designated in Alternatives A, B, or E. Over 2.1 million acres (86 percent) of nesting, roosting, and foraging habitat within areas of concern are in designated areas and lands otherwise unavailable for timber production (Table 3&4 – 14, Figure 3&4 – 10).

For this alternative there is a lowered risk of localized extinction of spotted owls due to demographic isolation for the Olympic Peninsula and Oregon Coast Range due to placement of the designated areas with emphasis on areas of concern. Spotted owl nesting, roosting, and foraging habitat in these areas in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber production is approximately 95 percent for the Olympic Peninsula area of concern and 83 percent for the Oregon Coast Range area of concern (Figures 3&4 – 8 and 9).

**Table 3&4 – 14 Areas of Concern, Alternative C**

Acres of National Forest and nesting, roosting, and foraging habitat in areas of concern<sup>1</sup>.

Alternative C	Area of Concern										Total
	Olympic Peninsula	North Cascades	Columbia Gorge	OR Coast Range	Santiam Pass	Klamath	Southern Deschutes	Shasta/ McCloud	Mendocino		
Total area of concern <sup>2</sup>	632,000	4,994,000	285,000	631,000	105,000	502,000	439,000	1,207,000	884,000	9,679,000	
Total owl habitat <sup>3</sup>	259,000	1,310,000	159,000	243,000	38,000	191,000	61,000	94,000	103,000	2,458,000	
Designated area <sup>4</sup> Owl habitats <sup>5</sup>	494,000 239,000	1,578,000 759,000	247,000 146,000	391,000 181,000	61,000 28,000	215,000 93,000	56,000 20,000	336,000 67,000	281,000 66,000	3,659,000 1,599,000	
Unavailable <sup>6</sup> Owl habitat <sup>7</sup>	21,000 6,000	2,780,000 417,000	19,000 6,000	67,000 21,000	18,000 4,000	84,000 26,000	236,000 15,000	495,000 13,000	427,000 15,000	4,147,000 523,000	

<sup>1</sup>Areas of concern, which include National Forests, as described in this chapter, see “Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat”. North Cascades column includes North Cascades East and Highway I-90. Acres rounded to nearest thousand and therefore may not add to totals shown.

<sup>2</sup>Total acres of National Forest within each area of concern.

<sup>3</sup>Total acres of nesting, roosting, and foraging habitat within areas of concern.

<sup>4</sup>Total acres of designated areas managed primarily for spotted owl habitat within areas of concern.

<sup>5</sup>Acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat.

<sup>6</sup>Total acres of land unavailable for timber production within areas of concern, including lands reserved at Chief's authority or higher, and other lands classified as unsuitable for timber production and nonforested lands, outside designated areas.

<sup>7</sup>Acres of nesting, roosting, and foraging habitat on lands unavailable for timber production.

## Criterion 2 Distribution Alternative D

**Alternative D.** The standards and guidelines for Alternative D protect the Habitat Conservation Areas delineated in Alternative B and all remaining spotted owl nesting, roosting, and foraging habitat as designated areas managed primarily for spotted owl habitat. Thus, owl habitat is well distributed throughout the range of the northern spotted owl. The result is more owl habitat designated in areas of concern than for other alternatives. Over 2.4 million acres (100 percent) of nesting, roosting, and foraging habitat within areas of concern are in designated areas and lands otherwise unavailable for timber production (Table 3&4 – 15, Figure 3&4 – 10).

The designation of all spotted owl habitat under this alternative assures protection of the maximum amount of habitat possible, thus substantially lowering the risk of localized extinction of populations due to demographic isolation for the Olympic Peninsula and Oregon Coast Range areas of concern relative to other alternatives (Figures 3&4 – 8 and 9).

**Table 3&4 – 15 Areas of Concern, Alternative D**

Acres of National Forest and nesting, roosting, and foraging habitat in areas of concern<sup>1</sup>.

Alternative D	Area of Concern										Total
	Olympic Peninsula	North Cascades	Columbia Gorge	OR Coast Range	Santiam Pass	Klamath	Southern Deschutes	Shasta/ McCloud	Mendocino		
Total area of concern <sup>2</sup>	632,000	4,994,000	285,000	631,000	105,000	502,000	439,000	1,207,000	884,000	9,679,000	
Total owl habitat <sup>3</sup>	259,000	1,310,000	159,000	243,000	38,000	191,000	61,000	94,000	103,000	2,458,000	
Designated area <sup>4</sup> Owl habitat <sup>5</sup>	481,000 259,000	2,021,000 1,310,000	253,000 159,000	391,000 243,000	55,000 38,000	296,000 191,000	88,000 61,000	288,000 94,000	307,000 103,000	4,180,000 2,458,000	
Unavailable <sup>6</sup> Owl habitat <sup>7</sup>	19,000 0	2,443,000 0	17,000 0	62,000 0	21,000 0	64,000 0	227,000 0	507,000 0	417,000 0	3,777,000 0	

<sup>1</sup>Areas of concern, which include National Forests, as described in this chapter, see “Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat”. North Cascades column includes North Cascades East and Highway 1-90. Acres rounded to nearest thousand and therefore may not add to totals shown.

<sup>2</sup>Total acres of National Forest within each area of concern.

<sup>3</sup>Total acres of nesting, roosting, and foraging habitat within areas of concern.

<sup>4</sup>Total acres of designated areas managed primarily for spotted owl habitat within areas of concern.

<sup>5</sup>Acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat.

<sup>6</sup>Total acres of land unavailable for timber production within areas of concern, including lands reserved at Chief's authority or higher, and other lands classified as unsuitable for timber production and nonforested lands, outside designated areas.

<sup>7</sup>Acres of nesting, roosting, and foraging habitat on lands unavailable for timber production. This is 0 for Alternative D since all nesting, roosting, and foraging habitat is in designated areas managed primarily for spotted owl habitat.

## **Criterion 2 Distribution Alternative E**

**Alternative E.** The standards and guidelines for Alternative E provide for Multiple-Pair Areas as designated areas managed primarily for spotted owl habitat throughout the Owl Management Zone. The exception is Reserved MPAs located in Wilderness on the Olympic National Forest and in the Olympic National Park, which are outside the Owl Management Zone. Lands outside MPAs and within the Owl Management Zone are managed for dispersal and connecting habitat. Approximately 2.9 million acres of National Forests within the range of the northern spotted owl occur outside the Owl Management Zone. The result is 15 percent of the range of the northern spotted owl for which no specific management is prescribed for northern spotted owl habitat.

Over 1.7 million acres (70 percent) of nesting, roosting, and foraging habitat within areas of concern are in designated areas and lands otherwise unavailable for timber production (Table 3&4 – 16, Figure 3&4 – 10). Alternative E does not prescribe specific management for three areas of concern. The Olympic Peninsula and Southern Deschutes areas of concern are outside the Owl Management Zone. The northern third of the Siuslaw National Forest in the Oregon Coast Range area of concern is also outside the Owl Management Zone. Spotted owl nesting, roosting, and foraging habitat for these areas in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber production is approximately 60 percent for the Olympic Peninsula area of concern, 56 percent for the Oregon Coast Range area of concern (Figures 3&4 – 8 and 9), and 31 percent for the Southern Deschutes area of concern. There are no designated areas for the Shasta/McCloud area of concern; this area is managed as connecting habitat only.

Implementation of Alternative E could lead to a high likelihood of localized extinction of owl populations due to demographic isolation on the Olympic Peninsula and Oregon Coast Range areas of concern.

The Owl Management Zone is narrower than the range of the northern spotted owl, especially in the Washington Cascades and the northern portion of the Oregon Cascades Provinces. Thus, the risk of a major catastrophic event causing isolation of subpopulations in these areas is increased as compared with Alternatives A, B, C, and D.

The Multi-Resource Strategy calls for egg or subadult transfers from the Cascade Mountains to the Olympic Peninsula to compensate for demographic and genetic isolation. This type of intensive hands-on management is usually used as a last resort to save a species from extinction. Without adequate amounts and quality of habitat available to transfer spotted owls into, success of this type of strategy is impossible. Juvenile survival is low even under good conditions. The transplanted northern spotted owl eggs and subadult spotted owls would come from populations in other parts of the range. The effect on viability of donor populations is unknown and not analyzed. Alternative E would result in lower amounts of habitat and lower expected northern spotted owl population sizes than occur at present, in any potential donor population.

**Table 3&4 – 16 Areas of Concern, Alternative E**Acres of National Forest and nesting, roosting, and foraging habitat in areas of concern<sup>1</sup>.

Alternative E	Area of Concern										Total
	Olympic Peninsula	North Cascades	Columbia Gorge	OR Range	Coast Pass	Santiam Pass	Klamath	Southern Deschutes	Shasta/ McCloud	Mendocino	
Total area of concern <sup>2</sup>	632,000	4,994,000	285,000	631,000	105,000	502,000	436,000	1,207,000	884,000	9,679,000	
Total owl habitat <sup>3</sup>	259,000	1,310,000	159,000	243,000	38,000	191,000	61,000	94,000	103,000	2,458,000	
Designated area <sup>4</sup>	88,000	975,000	173,000	103,000	23,000	72,000	0	0	184,000	1,618,000	
Owl habitat <sup>5</sup>	33,000	537,000	111,000	59,000	11,000	39,000	0	0	57,000	847,000	
Unavailable <sup>6</sup>	183,000	3,064,000	51,000	165,000	29,000	160,000	252,000	751,000	467,000	5,122,000	
Owl habitat <sup>7</sup>	122,000	500,000	21,000	77,000	10,000	49,000	19,000	71,000	16,000	885,000	

<sup>1</sup>Areas of concern, which include National Forests, as described in this chapter, section on Amount and Distribution of Northern Spotted Owl Nesting, Roosting, and Foraging Habitat. North Cascades column includes North Cascades East and Highway I-90. Acres rounded to nearest thousand and therefore may not add to totals shown.

<sup>2</sup>Total acres of National Forest within each area of concern.

<sup>3</sup>Total acres of nesting, roosting, and foraging habitat within areas of concern.

<sup>4</sup>Total acres of designated areas managed primarily for spotted owl habitat, including Deferred, Reserved, and Research MPAs, within areas of concern.

<sup>5</sup>Acres of nesting, roosting, and foraging habitat within designated areas managed primarily for spotted owl habitat.

<sup>6</sup>Total acres of land unavailable for timber production within areas of concern, including lands reserved at Chief's authority or higher, and other lands classified as unsuitable for timber production, outside designated areas.

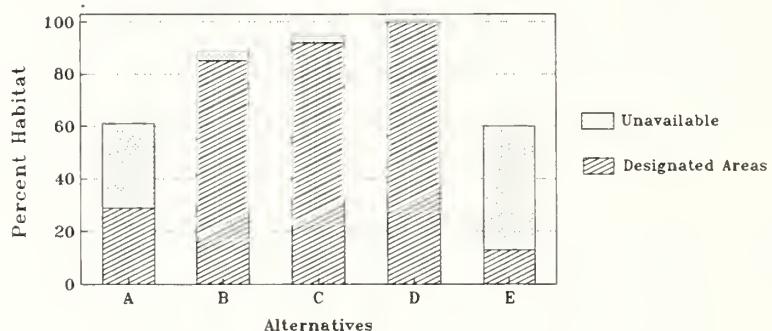
<sup>7</sup>Acres of nesting, roosting, and foraging habitat on lands unavailable for timber production.

<sup>8</sup>Total acres of research areas within areas of concern for Alternative E. Limited timber harvest is allowed in research areas.

<sup>9</sup>Acres of nesting, roosting, and foraging habitat within research areas.

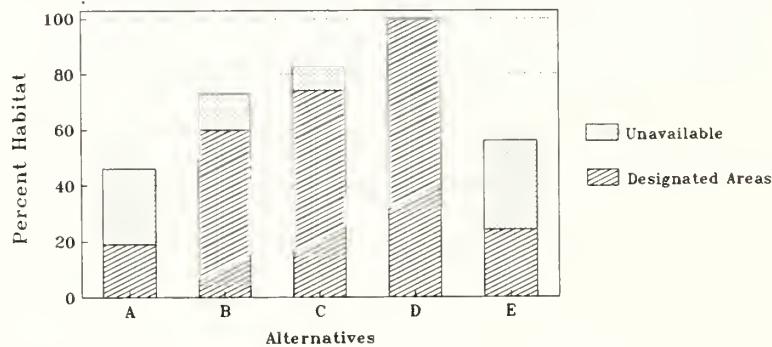
**Figure 3&4 – 8 Distribution for the Olympic Peninsula Area of Concern by Alternative, Criterion 2**

Percent spotted owl nesting, roosting, and foraging habitat within the Olympic Peninsula area of concern that is in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber management.



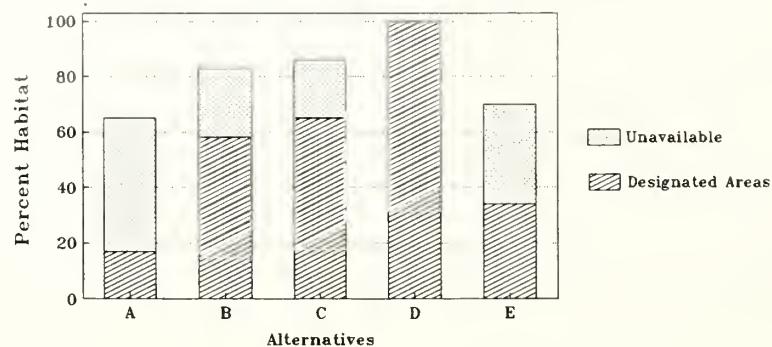
**Figure 3&4 – 9 Distribution for the Oregon Coast Range Area of Concern by Alternative, Criterion 2**

Percent spotted owl nesting, roosting, and foraging habitat within the Oregon Coast Range area of concern that is in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber management.



**Figure 3&4 – 10 Distribution for all Areas of Concern by Alternative, Criterion 2**

Percent nesting, roosting, and foraging habitat within areas of concern that is in designated areas managed primarily for spotted owl habitat and lands otherwise unavailable for timber management.



## Criterion 3: Habitat Capability

### Information Relative to All Alternatives

Habitat capability, estimated as potential number of pairs of northern spotted owls, within each population over time on National Forests.

Habitat capability is defined as the potential number of northern spotted owl pairs that a particular geographic location is capable of supporting, given predicted amounts and distribution of nesting, roosting, and foraging habitat. Habitat capability is not intended to represent an accurate estimate of current northern spotted owl population sizes, nor a precise prediction of actual future population sizes. Actual present and future population sizes will likely be different than habitat capability estimates. This is because many factors that could influence population sizes, including potential secondary effects of habitat fragmentation, predation, hybridization, fluctuations in prey abundance and availability, catastrophic habitat loss and modification, more extensive home range overlap than calculated, and other factors, are not quantified and are either not explicitly considered in this evaluation process, or will change in value as new research information is gathered.

The habitat capability evaluation is useful for comparing alternatives. Also, estimates of long-term trends in habitat capability provide a useful basis for evaluating the alternatives and for validation monitoring.

Habitat capability was calculated for each physiographic province by basing home range size on percent nesting, roosting, and foraging habitat within home range, and estimating the potential number of northern spotted owl pairs that a land area could support. Factors were used to correct home range area for overlap between adjacent pairs and percent habitat, and long-term persistence of local groups (clusters) of spotted owl pairs.

Habitat capability on lands outside National Forests was not calculated. However, habitat on National Parks and administered by Bureau of Land Management in Wilderness and other reserved areas is assumed to be protected over the long term. It is also assumed that BLM will manage their lands in accordance with the Endangered Species Act, Section 7(a), and thus will be contributing to overall habitat capability for the northern spotted owl. Spotted owls occurring on BLM lands in southern Oregon contribute to overall size and connectivity of spotted owl populations in and among the Oregon Cascades, Oregon Coast Range and Klamath Physiographic Provinces. Lands managed by the National Parks particularly contribute to the size of populations for the Olympic Peninsula and Washington Cascades Provinces.

It is assumed that spotted owls can freely interact within three groups of physiographic provinces: Olympic Peninsula; Washington Cascades; and Oregon Cascades, Oregon Coast Range and Klamath.

### *The Affected Environment and Environmental Consequences*

This assumption requires that BLM manage their lands in southwest Oregon in such a manner that owls can freely move between the Oregon Cascades, Oregon Coast Range and Klamath Provinces.

Under standards and guidelines for Alternatives B, C, and D experimentation with silvicultural practices will occur within the Forest Matrix, and in Research MPAs for Alternative E. One objective of applying such silvicultural prescriptions would be to maintain, create or accelerate the development of spotted owl nesting, roosting, and foraging habitat. If these silvicultural manipulations are successful, habitat capabilities in the Forest Matrix would be higher in the long term than those calculated for Alternatives B, C, and D. Under Alternative E habitat capabilities in Research MPAs might also be higher than those calculated.

Criterion 3: *Habitat Capability*

**Table 3&4 – 17 Habitat Capability by Alternative**

Habitat capability<sup>1</sup>, expressed as potential numbers of northern spotted owls pairs by physiographic province over time on National Forests.

Physiographic Province						
Year/ Alternative	Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast	Klamath Range	Total
<b>Year 0</b>						
Habitat Capability	72	499	1,013	110	851	2,544
<b>Year 150</b>						
<b>Alternative A</b>						
Habitat Capability						
Low Estimate <sup>2</sup>	18	129	247	22	352	767
High Estimate <sup>3</sup>	52	418	773	74	1,032	2,349
<b>Alternative B</b>						
Total Habitat <sup>4</sup>						
Capability	95	426	644	125	604	1,894
Designated Areas <sup>5</sup>	90	339	490	113	427	1,459
Matrix <sup>6</sup>	5	87	154	12	177	436
<b>Alternative C</b>						
Total Habitat <sup>4</sup>						
Capability	108	495	881	172	688	2,344
Designated Areas <sup>5</sup>	104	418	756	161	528	1,967
Matrix <sup>6</sup>	4	77	125	11	160	377
<b>Alternative D</b>						
Habitat Capability <sup>7</sup>	127	724	1,311	180	1,231	3,573
<b>Alternative E</b>						
Total Habitat <sup>4</sup>						
Capability	17	245	436	40	356	1,094
Designated Areas <sup>8</sup>	3	181	293	24	113	614
(includ Res MPAs) <sup>9</sup>	(0)	(42)	(49)	(15)	(24)	(130)
Other <sup>10</sup>	14	64	143	16	243	480

<sup>1</sup>Habitat capability estimation procedures are described in Appendix B. It is not expected that habitat capability will exactly equal actual pairs of spotted owls.

<sup>2</sup>Low estimate of habitat capability based on using five pair cluster correction factor. See Appendix B.

<sup>3</sup>High estimate of habitat capability based on using 100 pair cluster correction factor. See Appendix B.

<sup>4</sup>Total habitat capability, estimated as potential pairs of spotted owls, on all National Forest lands.

<sup>5</sup>Designated areas managed primarily for spotted owl habitat. Only those which are large enough to support five or more pairs of spotted owls are included.

<sup>6</sup>Forest Matrix includes all lands in all land classifications outside designated areas managed primarily for spotted owl habitat. It also includes designated areas which are large enough to support five or more pairs of spotted owls. Other also includes Deferred and Reserved MPAs.

<sup>7</sup>Habitat capability estimates assume all owls are interacting in a cluster of 100 pairs.

<sup>8</sup>Designated areas include Reserved, Deferred, and Research Multiple-Pair Areas.

<sup>9</sup>Research MPAs allow for some harvest of nesting, roosting, and foraging habitat. Numbers are included in designated area total.

<sup>10</sup>Other includes all lands in all land classifications outside Multiple-Pair Areas.

**Criterion 3  
Habitat  
Capability**

**Alternative A.** Population sizes are currently low for the Olympic Peninsula and the Oregon Coast Range Provinces. If these two populations maintain or increase their demographic isolation from other populations, they likely will not persist over the long term.

Habitat capability at year 150 is displayed with both a high and a low estimate (Table 3&4 – 17). The low estimate assumes that spotted owls are not interacting in clusters of more than five pairs and the high estimate assumes that spotted owls are interacting in clusters of 100 or more pairs. Future population sizes are expected to be closer to the low estimate as it is unlikely that owls will freely interact across all land areas under Alternative A, which results in total habitat capability at year 150 of 30 percent of current capability estimates.

Habitat capability at year 150 is low for both the Olympic Peninsula and Coast Range Provinces under both low and high estimates. The likelihood of maintaining viable populations of spotted owls in these physiographic provinces is low.

If actual population sizes are closer to the low estimate of habitat capability at year 150 then populations will be too small to ensure viable populations of spotted owls in any part of the range of the northern spotted owl.

**Alternative B.** Habitat capability at year 150 is higher than for Alternative A in all physiographic provinces. However habitat capability at year 150 is expected to be 74 percent of current capability estimates. Amounts of habitat will be lowest at year 50 before increasing and remaining constant by year 150. Habitat capability would also be expected to decrease before becoming stable by year 150.

Population sizes are currently low for the Olympic Peninsula and Oregon Coast Range Provinces. Under Alternative B, habitat capability increases for these populations over time, although they remain low.

**Alternative C.** Habitat capability across the range of the northern spotted owl over the long term is higher than for Alternatives A, B, and E. Habitat capability at year 150 is expected to be 92 percent of current capability estimates.

Habitat capability at year 150 on the Olympic Peninsula and Oregon Coast Range Provinces is increased due to the greater amount of habitat expected in the future in designated areas. However, contributions to habitat capability from Olympic National Park on the Olympic Peninsula and from BLM in the Oregon Coast Range are still necessary to ensure viable populations in these physiographic provinces.

By adding Critical Habitat Units to Habitat Conservation Areas under Alternative C, habitat capability over the long term increases by

### *Criterion 3: Habitat Capability*

approximately 14 percent for the Olympic Peninsula Province and 38 percent for the Oregon Coast Range Province, over Alternative B.

**Alternative D.** Under this alternative, habitat capability is expected to increase 40 percent over current capability estimates. Across the range of the northern spotted owl, future habitat capability is expected to be higher under Alternative D than under all other alternatives. In HCAs, nesting, roosting, and foraging habitat will be more contiguous in the future than at present time, whereas such habitat outside HCAs will retain their current distribution pattern.

Habitat capability will be low in the Olympic Peninsula and Oregon Coast Range Provinces at year 150. Thus, spotted owls on other Federal lands are important to the maintenance of viable populations of spotted owls for these physiographic provinces. In these two provinces, contribution to spotted owl populations from other Federal lands will significantly add to overall population sizes.

By adding all nesting, roosting, and foraging habitat outside of HCAs to HCAs, habitat capability over the long term increases by approximately 34 percent for the Olympic Peninsula Province and 44 percent for the Oregon Coast Range Province, over Alternative B.

**Alternative E.** Under this alternative, habitat capability for the Olympic Peninsula and Oregon Coast Range Provinces is low. Current habitat capability is low and capability declines over the 150-year period. It is highly unlikely that populations will persist in these two provinces under Alternative E.

Habitat capability in Connecting Habitat should be higher than for other lands outside MPAs, and contribute to the habitat capability in the “other” category.

Habitat capability for other populations under Alternative E is intermediate to that of Alternatives A and B. Total habitat capability at year 150 is expected to be 43 percent of current habitat capability.

This page left blank for notes

## Criterion 4: Dispersal

### Information Relative to All Alternatives

Provision for movement or dispersal habitat on National Forests outside of designated areas managed primarily for spotted owl habitat.

Movement and dispersal habitat is assumed to be provided on other Federal lands, most notably on Bureau of Land Management lands. BLM lands provide an important connection between the Oregon Coast Range Province and the Klamath and Oregon Cascades Provinces. This connection is vital for maintaining viability of spotted owls on National Forests in the Coast Range Province under any of the alternatives.

**Alternative A.** The standards and guidelines for Alternative A do not specify requirements for managing for dispersal habitat on lands outside of designated areas managed primarily for nesting, roosting, and foraging owl habitat.

Although management of dispersal habitat is not required under this alternative, some lands may currently provide dispersal habitat. However, they will not be of sufficient amount and adequate distribution to provide dispersal habitat in all areas over time.

**Alternatives B, C and D.** The standards and guidelines for Alternatives B, C and D specifically provide for movement and dispersal habitat (the 50-11-40 rule). Generally, at least 50 percent of the forest landscape is prescribed to consist of forest stands with a mean d.b.h. of 11 inches or larger and at least 40 percent canopy closure, to be provided on each quarter township. Some areas do not currently meet these requirements due to past activities or natural conditions. However, timber harvest will be permitted only if standards for movement and dispersal habitat are met, or if silvicultural management is shown to be the best way to meet the standards.

Provision for movement or dispersal habitat outside of designated areas managed primarily for spotted owl habitat will help provide for recolonization of northern spotted owls in designated areas, especially in the Klamath Mountains and Washington Cascades Provinces where designated areas are smaller than in other provinces.

Areas of concern with deficiencies in habitat connectivity have been identified earlier in this chapter. Alternatives C and D prescribe for designation of more habitat in these areas than does Alternative B (also see Criterion 2).

Alternative D provides for nesting, roosting, and foraging habitat in addition to the 50-11-40 rule between HCAs. Nesting, roosting, and foraging habitat between Habitat Conservation Areas contributes to meeting the the 50-11-40 requirement. Thus, Alternative D provides for better dispersal conditions than any of the other alternatives, and, in

## *The Affected Environment and Environmental Consequences*

particular, provide for a wide distribution of dispersal habitat across all physiographic provinces.

**Alternative E.** The standards and guidelines for Alternative E provide for movement and dispersal habitat within the Owl Management Zone. Specifically, each watershed of approximately 5,000 to 10,000 acres should contain at least 40 percent habitat suitable for dispersal. The Multi-Resource Strategy describes dispersal habitat as 40 percent canopy cover with clearance under the canopy averaging greater than 20 feet. Additionally, Connecting Habitat corridors are designated between Reserved and Deferred MPAs. Lands outside MPAs within the Owl Management Zone on the Siuslaw National Forest and in California are managed as Connecting Habitat. Standards and guidelines prescribe that 30 to 50 percent of Connecting Habitat occur in nesting, roosting, and foraging habitat per watershed. As with the other alternatives, lands reserved from timber harvest in Forest Plan allocations will also provide some habitat for dispersing spotted owls.

There are no specific provisions for dispersal habitat outside the Owl Management Zone. On National Forests, 85 percent of the total range of the northern spotted owl is covered by the Owl Management Zone. Thus, 15 percent of the total range on National Forests would contain no specific designated dispersal habitat for spotted owls. For this reason the Olympic Peninsula, parts of the Oregon Coast Range, North Cascades East and Southern Deschutes areas of concern in which habitat connectivity is deficient receive no provisions for dispersal habitat.

The initial dispersal directions taken by juvenile spotted owls appear to be random; subsequent directions cross many forest and topographic boundaries (Miller 1989; Gutierrez et al. 1985). For this reason, spotted owls are not expected to use corridors significantly more than the remainder of the landscape. However, when combined with standards and guidelines for dispersal habitat in this alternative adequate dispersal conditions are provided within the Owl Management Zone.

## Criterion 5: Spacing

Spacing between designated areas managed primarily for spotted owl habitat, measured between boundaries of designated areas on National Forests.

### Information Relative to All Alternatives

First, second, and third nearest distances were measured between boundaries of designated areas managed primarily for spotted owl habitat. Distances were measured between designated areas only on National Forests and within each physiographic province. Distances would be lower if designated areas were managed on other Federal lands, particularly for the Oregon Coast Range Province. Because all nesting, roosting, and foraging habitat is designated under Alternative D, distances were measured only between HCAs (see Table 3&4 – 18).

**Alternative A.** The standards and guidelines for Alternative A stipulate groupings of up to three designated areas areas managed primarily for spotted owl habitat, each for one pair of northern spotted owls. Such groupings should be spaced less than or equal to 12 miles edge to edge. The distance from a designated area managed primarily for spotted owl habitat to another single pair area or to a grouping should be less than or equal to 6 miles, measured edge to edge. However, in Oregon and Washington distances could be increased by 20 percent (up to 7.2 miles for singles and 14.4 miles for clusters). This variation applies only where needed to locate a designated area at a site with a higher level of occupancy by spotted owls (e.g., contains a pair, rather than a single bird).

Actual spacing of mapped SOHAs is closer than prescribed by standards and guidelines for Alternative A. At least 70 percent of radio-tagged juvenile spotted owls dispersed distances at least as far as the first, second, and third nearest distances between SOHAs in all physiographic provinces. Because SOHAs are small, spacing needs to be close to help ensure successful dispersal between designated areas. Thus, spacing of SOHAs seems to be adequate to ensure successful dispersal of spotted owls.

**Alternatives B, C and D.** The standards and guidelines for Alternatives B, C and D stipulate a maximum of 12 miles edge to edge between designated areas supporting 20 or more pairs of owls, and a maximum of 7 miles between designated areas supporting 2-19 pairs of owls. Some designated areas will be farther apart unless designated areas managed for owl habitat occur on interspersed lands managed by other agencies.

Under Alternative B, actual spacing of mapped HCAs on National Forests is closer than prescribed by standards and guidelines. At least 75 percent of radio-tagged juvenile spotted owls dispersed distances at least as far as the the first nearest distance between HCAs in all physiographic provinces. Distances between HCAs are the greatest in the Oregon Coast Range. Only 43 percent of radio-tagged juveniles

## *The Affected Environment and Environmental Consequences*

dispersed distances greater than the second nearest distance. Due to the isolated nature of the Oregon Coast Range from other National Forests, BLM lands are important to maintaining well spaced designated areas, and distances would be closer if measurements included HCAs on BLM lands.

For Alternative C, the addition of Critical Habitat Units identified by the U.S. Fish and Wildlife Service reduces the space between designated areas managed primarily for owl habitat on National Forests. Under Alternative C for the Oregon Coast Range Province 80 percent of juveniles would be able to disperse the first and second nearest distances between CHUs.

For Alternative D, in addition to the Habitat Conservation Areas delineated in Alternative B, all remaining spotted owl nesting, roosting, and foraging habitat outside these areas is also designated as areas managed primarily for owl habitat. Thus, the distance between designated areas on National Forests for Alternative D is less than for the other alternatives. Distances between HCAs would be the same as with Alternative B.

**Alternative E.** The standards and guidelines for Alternative E stipulate a maximum of 15-mile spacing between boundaries of designated areas in Oregon and Washington and 12 miles in California. Actual spacing of mapped MPAs is closer than specified by standards and guidelines. Measurements would be even lower if designated areas on BLM lands were included.

Under Alternative E, MPAs are located in a narrower, more linear, band along the Washington and northern Oregon Cascades than for other alternatives. As a result, distances to third nearest sites are farther under this alternative when compared to the other alternatives.

Connecting Habitat corridors between Deferred and Reserved MPAs might provide for higher densities of northern spotted owls than in other dispersal habitat. However, they were not considered in measurements between designated areas.

## Criterion 5: Spacing

**Table 3&4 – 18 Spacing by Alternative, Criterion 5**

Average first, second, and third nearest distances between designated areas managed primarily for spotted owl habitat on National Forests, and percent of juvenile spotted owls known to disperse those distances<sup>1</sup>.

Physiographic Province													
Alternative	Olympic Peninsula		Washington Cascades		Oregon Cascades		OR Coast Range		Klamath		Total Range		
	Dist <sup>2</sup>	% <sup>3</sup>	Dist <sup>2</sup>	% <sup>3</sup>	Dist <sup>2</sup>	% <sup>3</sup>	Dist <sup>2</sup>	% <sup>3</sup>	Dist <sup>2</sup>	% <sup>3</sup>	Dist <sup>2</sup>	% <sup>3</sup>	
A	1st	2.0	96	2.3	93	3.0	93	2.8	93	3.1	93	2.7	93
	2nd	8.0	75	4.7	89	4.9	89	5.7	84	4.9	89	5.1	88
	3rd	11.4	70	6.7	82	6.6	82	9.7	73	7.3	77	7.2	77
B <sup>4</sup>	1st	0.00	100	4.1	89	5.1	88	8.2	75	4.2	89	3.2	93
	2nd	-----	---	7.0	77	9.1	73	19.6	43	7.8	77	6.0	84
D <sup>4</sup>	3rd	-----	---	9.4	73	16.1	55	25.4	30	12.8	68	10.0	70
C	1st	1.5	96	2.4	93	2.6	93	1.5	96	3.8	91	2.8	93
	2nd	-----	---	6.3	82	5.7	88	6.9	80	7.6	77	6.0	84
	3rd	-----	---	9.9	73	9.1	73	13.8	66	12.9	68	11.0	70
E <sup>5</sup>	1st	5.3	88	3.8	91	4.2	91	12.5	68	4.4	89	4.8	89
	2nd	15.3	62	9.1	73	9.4	73	14.6	64	11.8	68	10.8	70
	3rd	-----	---	17.1	52	16.3	55	34.8	14	15.7	62	17.5	50

<sup>1</sup>Based on dispersal distance of radio-tagged juvenile spotted owls, from the same data set reported in the ISC Report (Thomas et al. 1990).

<sup>2</sup>Distances between designated areas managed primarily for spotted owl habitat, in miles.

<sup>3</sup>Percent of radio-tagged juvenile spotted owls known to disperse that distance.

<sup>4</sup>Includes distances between Category 1 and 2 HCAs. For Alternative D, all nesting, roosting, and foraging habitat between HCAs is also designated but was not included in distance measurements.

<sup>5</sup>Includes distances between Reserved, Deferred, and Research MPAs.

**Criterion 6:  
Patch Size**

Provision for size and distribution of spotted owl nesting, roosting, and foraging habitat patches within designated areas managed primarily for spotted owl habitat on National Forests.

**Alternative A.** The standards and guidelines for Alternative A do not provide for an increase in habitat patch size over time for a designated pair area by blocking forest stands into more contiguous patterns. In some cases, younger forests which are not yet spotted owl habitat may be included in boundaries of SOHAs. However, patch size may actually decrease over time because small patches with large amounts of edge are susceptible to trees blown down by high winds.

**Alternatives B, C, D, and E.** The standards and guidelines for Alternatives B, C, D, and E provide for an increase of habitat patch size within designated areas. These areas include spotted owl nesting, roosting, and foraging habitat and younger stands capable of becoming nesting, roosting, and foraging habitat in the future. In the absence of natural catastrophes, application of standards and guidelines for Alternatives B, C, D and E will eventually lead to large contiguous patches of nesting, roosting, and foraging habitat.

Alternatives B, C, D, and E eventually provide for more habitat and more contiguous habitat than Alternative A, even in the short term. These conditions will lead to a higher likelihood of occupancy of reproductive pairs over time. Although opportunities for increasing habitat patch size and contiguity are limited for the Oregon Coast Range and Washington Cascades Provinces, these four alternatives provide larger and better connected patches than does Alternative A.

Under Alternative C, designated areas would be larger than those under Alternatives B and E. This would lead to larger patches of nesting, roosting, and foraging habitat than for Alternatives B and E; therefore, occupancy rates by reproductive pairs would be incrementally higher.

For Alternative D, designated areas managed primarily for spotted owl habitat include HCAs and all remaining nesting, roosting, and foraging habitat. Thus, not only will all spotted owl nesting, roosting, and foraging habitat be protected, but some younger forests will become spotted owl habitat in the future.

Under Alternative E, MPAs are generally smaller than designated areas managed primarily for spotted owl habitat in Alternatives B, C, and D. Therefore, occupancy rates by reproductive pairs would be incrementally lower.

Within Deferred MPAs habitat patch size would increase. Patch size within Reserved MPAs should remain fairly constant over time.

#### *Criterion 6: Patch Size*

Nesting, roosting, and foraging habitat is expected to increase in Research MPAs over time, however nesting, roosting, and foraging habitat may be decreased 20 percent from amounts that would occur if the area were a Deferred MPA. Depending on harvest patterns and current conditions, habitat might or might not become more contiguous in these areas.

This page left blank for notes.

## **Criterion 7: Clustering**

### **Information Relative to All Alternatives**

Provision for designated areas large enough to support multiple pairs of spotted owls on National Forests.

Cluster size was not calculated in exactly the same manner as in the ISC Report (Thomas et al. 1990). Cluster size was calculated for year 150 using the habitat capability estimates described in Appendix B of this environmental impact statement. Cluster sizes were not calculated for the current point in time because designated areas managed primarily for spotted owl habitat are still part of the general population interacting across the landscape. Habitat capability estimates correct for expected occupancy based on cluster size and percent habitat. Thus based on modeling reported in the ISC Report (Thomas et al. 1990), clusters of about 15 pairs of owls should be stable over time. Clusters of 20 pairs, as stated in the standards and guidelines in the ISC Report, account for the expectation that not all pair sites will be occupied at any one point in time. Because these cluster sizes are adjusted for expected occupancy rates, clusters of 15 owl pairs are assumed to be similar to 20-pair clusters in the ISC standards and guidelines.

Only designated areas managed primarily for spotted owl habitat which were large enough to support five or more pairs of owls were analyzed as a cluster for this criterion. Clusters of at least five pairs of spotted owls were the smallest cluster size Voss and Noon analyzed for expected occupancy rates (Thomas et al. 1990, Appendix Q).

Portions of designated HCAs and CHUs are mapped for other Federal lands. However, only those portions on National Forests were included in calculations of cluster size.

**Alternative A.** The standards and guidelines for Alternative A stipulate that areas be designated for either single owl pairs or clusters of three owl pairs. However, the amount of habitat designated per owl pair is less than that used by pairs observed in field studies. Thus, expected occupancy rates of owl pairs within designated areas will eventually be low.

No clusters of five or more pairs of owls are expected to occur in the future under Alternative A.

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 19 Clustering, Alternative B**

Frequency distribution of number of designated areas managed primarily for spotted owl habitat by cluster size on National Forests.

Cluster Size	Physiographic Province						Total
	Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	-	
5-9	0	4	1	3	4	-	12
10-14	0	5	1	2	3	-	11
15-19	0	2	0	0	6	-	8
20-24	0	1	4	3	6	-	14
25-29	0	1	7	0	1	-	9
30+	1	3	5	0	2	-	11

<sup>1</sup>Cluster size is based on habitat capability estimates at year 150, expressed as potential pairs of spotted owls. Estimation procedures are described in Appendix B. Because these cluster sizes are adjusted for expected occupancy rates, clusters of 15 owl pairs are assumed to be similar to 20-pair clusters in the ISC standards and guidelines.

**Table 3&4 – 20 Clustering, Alternative C**

Frequency distribution of number of designated areas managed primarily for spotted owl habitat by cluster size class on National Forests.

Cluster Size	Physiographic Province						Total
	Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	-	
5-9	0	4	2	1	2	-	9
10-14	0	3	2	2	4	-	11
15-19	0	3	2	1	3	-	9
20-24	0	1	1	1	6	-	9
25-29	0	2	1	2	3	-	8
30+	1	3	14	1	4	-	23

<sup>1</sup>Cluster size is based on habitat capability estimates at year 150, expressed as potential pairs of spotted owls. Estimation procedures are described in Appendix B. Because these cluster sizes are adjusted for expected occupancy rates, clusters of 15 owl pairs are assumed to be similar to 20-pair clusters in the ISC standards and guidelines.

**Alternatives B, C and D.** The standards and guidelines for Alternatives B, C and D stipulate that designated areas managed primarily for spotted owl habitat should be large enough to support 20 or more pairs of spotted owls wherever possible.

Under these alternatives, provisions for these size clusters of owls will help ensure persistence of owls. Also, because more habitat will be protected in larger designated areas, the likelihood of persistence of owls for the Olympic Peninsula and Oregon Coast Ranges Provinces will be greater than under Alternative A.

At present, it is not possible to designate clusters of 20 or more pairs everywhere because of natural habitat limitations, and past management activities. This condition applies directly to Alternatives B, C and D. Habitat distribution for the Klamath and Washington Cascades Provinces offer few opportunities to provide clusters of 20 or more pairs of owls.

Alternative B provides for more large clusters than Alternative E, but not as many as Alternative C. Under Alternative B, 42 of 65 clusters are large enough to support 15 or more pairs of spotted owls (Table 3&4 – 19 and Figure 3&4 – 11). Under Alternative C, 49 of 69 clusters support 15 or more pairs of spotted owls (Table 3&4 – 20 and Figure 3&4 – 12).

For Alternative D, it is unknown to what extent owl habitat outside of HCAs would facilitate the clustering of spotted owls. At a minimum, cluster size would equal that for Alternative B; at a maximum, all spotted owls would be interacting as one cluster within each physiographic province.

**Alternative E.** The standards and guidelines for Alternative E stipulate that Reserved and Deferred MPAs should each be large enough to support at least 20 pairs of northern spotted owls in Oregon and Washington and at least 10 pairs each in California. Research MPAs should be large enough to support 15 pairs each in Washington and Oregon and at least 10 pairs each in California.

Alternative E provides for more large clusters than Alternative A, but not for as many large clusters as would Alternatives B, C, and D (Table 3&4 – 21, and Figure 3&4 – 13). Based on habitat capability estimates for clusters which support five or more pairs of spotted owls, 9 of 41 clusters are large enough to support 15 or more pairs of owls.

The National Forest in the Olympic Peninsula Province has no clusters large enough to support five or more pairs of owls. Owls in the Olympic National Park will contribute to cluster size. However, owls on higher-elevation lands within and around the Park might be divided into isolated subgroups if timber harvest reduces habitat in lower elevations.

## The Affected Environment and Environmental Consequences

The Oregon Coast Range has only two clusters in the five to nine pair class. Persistence of owls in these small clusters is highly uncertain.

**Table 3&4 – 21 Clustering, Alternative E**

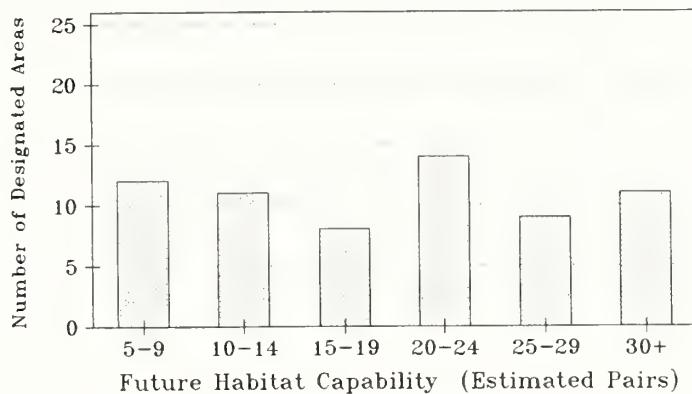
Frequency distribution of number of designated areas managed primarily for spotted owl habitat and Research MPAs<sup>1</sup> by cluster size<sup>2</sup> class on National Forests.

Cluster Size <sup>2</sup>	Physiographic Province					Total
	Olympic Peninsula	Washington Cascades	Oregon Cascades	OR Coast Range	Klamath	
5-9	0	4	6	2	10	22
10-14	0	5	5	0	0	10
15-19	0	1	3	0	1	5
20-24	0	0	0	0	0	0
25-29	0	0	0	0	0	0
30+	0	1	3	0	0	4

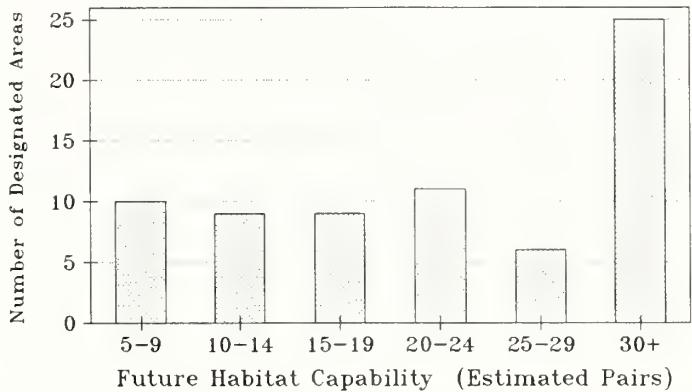
<sup>1</sup>Research MPAs allow for silvicultural manipulation or harvest of up to 20 percent of spotted owl nesting, roosting, and foraging habitat that would be expected to occur if the areas were Deferred MPAs.

<sup>2</sup>Cluster size is based on habitat capability estimates at year 150, expressed as potential pairs of spotted owls. Estimation procedures are described in Appendix B. Because these cluster sizes are adjusted for expected occupancy rates, clusters of 15 pairs are assumed to be similar to 20-pair clusters in the ISC standards and guidelines.

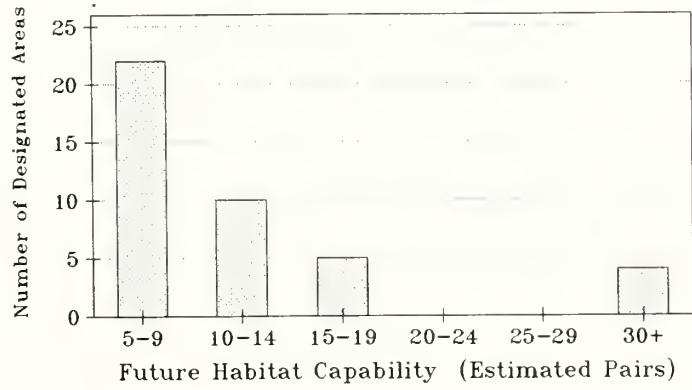
**Figure 3&4 - 11 Cluster Size of Designated Areas, Alternative B**  
 Number of designated areas managed primarily for spotted owl habitat by cluster size on National Forests.



**Figure 3&4 - 12 Cluster Size of Designated Areas, Alternative C**  
 Number of designated areas managed primarily for spotted owl habitat by cluster size on National Forests.



**Figure 3&4 - 13 Cluster Size of Designated Areas, Alternative E**  
 Number of designated areas managed primarily for spotted owl habitat by cluster size on National Forests.



This page left blank for notes

## Overall Viability Rating for the Alternatives

---

### Defining the Ratings

#### Ratings which Denote the Relative Security from Threats to Population Viability

Definitions of Rating values:

(Modified from rating system in Schonewald-Cox 1983, as presented in Marcot et al. 1986)

**HIGH** Denotes a high likelihood of viability because:

- A well-distributed population is maintained at least throughout the current geographic and ecological range of the owl.
- The number and distribution of owls is sufficient to avoid local extinctions and to provide for recolonization of vacant habitats.
- Connected populations throughout the range on National Forests ensure protection of genetic diversity of the subspecies.
- The number of designated areas and distribution of habitat provides sufficient immigrants for recolonization after catastrophic, demographic, or genetic problems.
- It provides a broad latitude for natural catastrophes and uncertainties in knowledge.
- Habitat conditions mostly assure a stable or increasing population.

**MEDIUM** Denotes an uncertain likelihood (perhaps a 50 percent chance) of viability because:

- Populations may be well distributed, but may be isolated from each other.
- Number and distribution of owls, habitat connection, and number and distribution of designated areas is unlikely to be sufficient to ensure recolonization of vacated habitats.
- It provides a limited latitude for natural catastrophes and uncertainties in knowledge.
- It is uncertain if habitat conditions provide for a stable or increasing population.

**LOW** Denotes a low likelihood of viability because:

- Populations are likely to be small, poorly distributed and isolated from each other.
- Number and distribution of owls, habitat connection, and number and distribution of designated areas is insufficient to ensure recolonization of vacated habitats.
- It provides almost no latitude for natural catastrophes and uncertainties in knowledge.
- Habitat conditions do not provide for a stable or increasing population.

## *The Affected Environment and Environmental Consequences*

### **Overall Viability Rating for the Alternatives**

This section presents the overall assessment of viability under each alternative. A panel of spotted owl scientists and experts was convened to discuss and evaluate viability criteria under each alternative. The overall rating for each alternative combined quantitative analyses with the panel's collective professional judgment and specific scientific knowledge of spotted owl population dynamics and habitat conditions.

This discussion addresses the two major categories affecting population viability: numbers (size of populations and clusters of pairs) and distribution (spatial patterns of habitats and spotted owls). Viability criteria were evaluated as to how well each alternative provides for adequate numbers and distribution over space and time, to ensure viable populations well distributed throughout the range of the northern spotted owl within National Forests. With respect to the viability of the northern spotted owl, short term refers to approximately the next 50 years, and long term refers to a century or longer.

#### **Summary of Viability Ratings:** (potential ratings of LOW, MEDIUM, or HIGH):

Alternative A - LOW likelihood of population viability  
Alternative B - HIGH likelihood of population viability  
Alternative C - HIGH likelihood of population viability  
Alternative D - HIGH likelihood of population viability  
Alternative E - LOW likelihood of population viability

The above viability ratings assume other Federal agencies will manage their lands with a level of owl protection similar to the ISC Strategy, through consultation with U.S. Fish and Wildlife under Section 7(a) of the Endangered Species Act. Participation by the Bureau of Land Management is necessary to provide for high population viability under Alternatives B through D. BLM lands are particularly important to populations for the Oregon Coast Range Province and interchange between the Klamath and Oregon Cascades Provinces. National Park lands are particularly important to viability of northern spotted owls for the Olympic Peninsula Province.

If the Endangered Species Committee were to grant BLM an exemption from requirements of the Endangered Species Act, Section 7(a), this viability assessment would need to be reconsidered.

### **Viability Rating Alternative A**

**Alternative A** would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term and thus would not ensure a well distributed viable population.

**Numbers.** Under Alternative A, habitat capability at year 150 is expected to be 30 percent of current habitat capability. This estimate assumes owls will not freely interact across all land areas under this alternative. Alternative A has no provision for conserving relatively

large clusters of pairs (20 or more pairs), which have substantially greater likelihoods of persistence than do small clusters of pairs (1 to less than 10 or so pairs). Designated areas will likely become partially or fully unoccupied over time, because pair clusters are too small to be self-sustaining and because habitat distribution likely would not encourage successful recolonization of vacant sites. Also, there is little or no provision for young forests to grow into nesting, roosting, and foraging habitat condition. Thus, population sizes will likely never increase. Two spotted owl populations currently at greatest risk, the Oregon Coast Range and Olympic Peninsula populations, would continue to decline in size and would become even more imperiled than at present.

Under Alternative A, if actual population sizes are closer to the low estimate of habitat capability at year 150 as expected, then populations will be too small to ensure the viability of northern spotted owls in any part of the owl's range.

In many areas, numbers and densities of owl pairs are already low enough to warrant significant concern regarding their continued persistence and interaction. Alternative A would intensify this situation.

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative A would also cause a low likelihood of population persistence over time. Specifically, the chance of reproductive pairs continuing to occupy home ranges would decline over time because, at the scale of pair home ranges, nesting, roosting, and foraging habitat would be designated in small, discontinuous patches. Alternative A would also cause increases in fragmentation of forest habitat, which in turn would likely degrade habitat quality within the forest stands and might lead to blowdown of trees along exposed forest edges.

In addition, Alternative A does not provide for movement or dispersal habitat. This would likely lead to increases in mortality rates of spotted owls moving or dispersing among designated areas. The result would be substantial declines in the successful recolonization of habitats as territorial paired owls die or move. Other problems with ensuring short-term and long-term distribution of spotted owl habitat under Alternative A include no specific provision for improving current distribution problems in areas of concern, and very limited provision for resolving catastrophic loss of habitat. All of these conditions would likely not provide for well distributed populations over time.

Alternative A was also rated as providing a low likelihood of viability of spotted owl populations in a report by the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991). The Interagency Scientific Committee also stated that the SOHA strategy would result in significant risk to the long-term persistence of the subspecies (Thomas et al. 1990: 384).

**Viability  
Rating  
Alternative B**

**Alternative B** would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests overall, and thus would ensure a well distributed viable population over the long term.

**Numbers.** Alternative B would provide spotted owl habitat capability at substantially higher levels than under Alternative A. Habitat capability at year 150 is expected to be 74 percent of current capability estimates. Alternative B would result in a substantially lower rate of habitat loss than under Alternative A, and for a stable habitat base in the long term.

Alternative B also provides for relatively large (20-pair) clusters of spotted owl pairs. Such cluster sizes would likely result in substantially greater likelihoods of persistence and occupancy by spotted owl pairs than would small cluster sizes. In addition, Alternative B provides for designation of a substantial area of young forests to become suitable spotted owl habitat over time for additional pairs. These young forests often occur in locations critical for eventually enhancing pair cluster sizes and connectivity within clusters. This would enhance connectivity with other designated areas managed primarily for spotted owl habitat over the long term, as well as provide for additional sources of reproductive pairs.

**Distribution.** Distribution of spotted owls and spotted owl habitat under Alternative B would provide for long-term interaction of spotted owls and spotted owl pairs within and among designated areas over time. Alternative B provides for nesting, roosting, and foraging habitat in large and contiguous blocks. Alternative B also provides for a substantial amount of young forests to grow into nesting, roosting, and foraging habitat forest conditions over time within designated areas managed primarily for spotted owl habitat (Habitat Conservation Areas), further enhancing interaction of owls and recolonization of vacated sites.

Alternative B also specifically designates movement and dispersal habitat among designated areas managed primarily for spotted owl habitat. This is a major provision that substantially enhances the occupancy rates of spotted owls within designated areas by allowing for recolonization among pair clusters. It would also likely result in well distributed populations over time.

Clusters of pairs are to be provided in large sizes generally adequate to withstand some catastrophic loss of nesting, roosting, and foraging habitat. Also, although spacing criteria of designated areas is similar to that of Alternative A, the larger cluster sizes greatly enhance both occupancy rates within designated areas and successful movement of owls among designated areas. These factors are critical to ensuring long-term persistence of spotted owl pairs within designated areas and populations.

There are still concerns for persistence of the Oregon Coast Range and Olympic Peninsula populations because these populations are small and at least partially isolated from other populations, and because forest habitats are highly fragmented. Alternative B addresses these areas of concern and provides for increased conservation of nesting, roosting, and foraging habitat therein.

The ISC Report (Thomas et al. 1990) also emphasized concerns for the subspecies in portions of its range. However, their conclusion was that full implementation (that is, on all lands) of the ISC Strategy would provide for a high likelihood of population persistence over the next century throughout its current range. Further, the Scientific Panel on Late Successional Forest Ecosystems also concluded that the ISC Strategy would provide for a high likelihood of persistence of the subspecies (Johnson et al. 1991).

On December 18, 1991, the U.S. Fish and Wildlife Service issued their biological opinion on the Draft Environmental Impact Statement and stated "It is the biological opinion of the Service that adoption of the preferred alternative B, the Interagency Scientific Committee's *A Conservation Strategy for the Northern Spotted Owl* (Conservation Strategy) [Thomas et al. 1990], is not likely to jeopardize the continued existence of the northern spotted owl."

## Viability Rating Alternative C

**Alternative C** would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** In general, Alternative C provides for a greater degree of habitat conservation than does Alternative B. Alternative C provides for a stable to increasing habitat base over the long term. The greater degree of habitat conservation and the increase in habitat would aid in providing for larger spotted owl population sizes over the long term, and in an incrementally greater likelihood of population persistence than under Alternative A, B, or E. Habitat capability at year 150 is estimated to be 92 percent of current capability estimates.

Alternative C also provides for large designated areas managed primarily for spotted owl habitat, and thus large clusters of pairs. This would provide for a high persistence of pair clusters and a high likelihood of reoccupancy of vacant habitats. Long-term occupancy is likely to be higher under Alternative C than under Alternative A, B, or E. As with Alternative B, Alternative C provides for designation of a substantial area of young forests to become spotted owl nesting, roosting, and foraging habitat over time for additional, individual pairs. This would enhance connectivity with designated areas over the long term, as well as provide for additional sources of habitat for reproductive pairs.

## *The Affected Environment and Environmental Consequences*

**Distribution.** Distribution of designated areas under Alternative C would provide for more nesting, roosting, and foraging habitat in the large and contiguous blocks. This would improve over time as young forests within designated areas under Alternative C grow into nesting, roosting, and foraging habitat condition. Designated areas under Alternative C are larger and more closely spaced than under Alternative A, B, or E. These conditions would result in a higher likelihood of maintaining well distributed populations over time.

In addition, Alternative C specifically provides for movement and dispersal habitat among designated areas. This would significantly increase the likelihood that nesting, roosting, and foraging habitat in designated areas would continue to be occupied and recolonized over time. Also, Alternative C provides for conservation and restoration of nesting, roosting, and foraging habitat conditions in areas of concern, including Oregon Coast Range and Olympic Peninsula populations. The size of designated areas under Alternative C would be adequate to withstand some catastrophic losses of nesting, roosting, and foraging habitat. Overall, Alternative C would likely result in well distributed populations over time.

## **Viability Rating Alternative D**

**Alternative D** would provide for a HIGH likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would ensure a well distributed viable population.

**Numbers.** Habitat capability provided under Alternative D is likely to ensure persistence of populations. Habitat capability at year 150 is estimated to increase 40 percent over current capability estimates. Over the long term, Alternative C would provide for a greater amount of young forests to grow into nesting, roosting, and foraging habitat conditions than would Alternative D. Also, additional habitat designated outside Habitat Conservation Areas under Alternative D would occur in fragmented and discontinuous patterns and with a great degree of variation of habitat patch sizes. Alternative D would provide for an overall increase in habitat. Loss of habitat from trees blown by high winds and other edge-related events might be higher than Alternatives B, and C. Still, Alternative D does provide for a stable nesting, roosting, and foraging habitat base over the short term and an increase in habitat over the long term. Alternative D would also designate areas of young forests that would grow into nesting, roosting, and foraging habitat condition over the long term.

For all these reasons, Alternative D provides for population viability incrementally better than does Alternatives A, B, and E. In the long term, differences between Alternatives C and D are unclear.

**Distribution.** Alternative D would designate larger contiguous habitat areas than under Alternative B. Also, Alternative D would protect all remaining nesting, roosting, and foraging habitat between the Habitat

## *Overall Viability Rating for the Alternatives*

Conservation Areas. This would enhance the likelihood of successful movement and dispersal of spotted owls between designated areas. Alternative D also provides for specific conservation and restoration of habitat in areas of concern. The size of designated areas under Alternative D also would be adequate to withstand some catastrophic losses of nesting, roosting, and foraging habitat.

### **Viability Rating Alternative E**

**Alternative E** would provide for a LOW likelihood of viability of northern spotted owl populations on National Forests over the long term, and thus would not ensure a well distributed viable population.

**Numbers.** Under Alternative E, the amount of nesting, roosting, and foraging habitat would decline in the short and long term. Spotted owl population numbers would also be expected to decline. Habitat capability at year 150 is expected to be 43 percent of current capability estimates. This alternative does provide for clusters of owls; there are fewer clusters than in Alternatives B, C, and D. Many of the clusters are smaller than the size thought to be necessary for long-term persistence.

Two northern spotted owl populations currently at greatest risk, those on the Oregon Coast Range and Olympic Peninsula, will have low habitat capability at year 150. Under Alternative E there is a distinct probability of localized extinctions in these two areas.

**Distribution.** This alternative does not prescribe specific management for spotted owl habitat over all National Forests within the range of the northern spotted owl. In the long term it is likely that the range of the northern spotted owl would be significantly reduced and entire subpopulations lost. Portions of the owl's range on the east side of the Cascade Mountains in Oregon and Washington, the north Oregon Coast Range, and the Olympic Peninsula are outside the Owl Management Zone, a total of 2.9 million acres, or 15 percent, of National Forest within the range of the northern spotted owl.

Alternative E does provide for dispersal between designated areas, but only within the Owl Management Zone. No provisions are given for dispersal habitat in the large area outside the Owl Management Zone.

Alternative E includes no specific provision for improving current distribution problems in the Olympic Peninsula area of concern, and portions of the Oregon Coast Range, Washington Cascades East, Southern Deschutes and Shasta/McCloud areas of concern. Lack of specific protection of nesting, roosting, and foraging habitat within these areas of concern will lead to greater degrees of isolation within and among northern spotted owl populations.

Under this alternative, more emphasis is placed on designated areas in Wilderness and other high elevation lands than the other alternatives,

### *The Affected Environment and Environmental Consequences*

especially in the Oregon and Washington Cascades. Few high quality, low elevation habitats are included in the Deferred and Reserved MPAs.

Under this alternative, there is limited latitude for catastrophic events. A major catastrophic event could isolate populations in the Washington Cascades and northern Oregon Cascades Provinces due to the narrow band of designated areas.

All of the conditions above, especially limited distribution and small cluster sizes, result in a low likelihood of viability of northern spotted owl populations in well distributed patterns. There is a distinct probability of local population declines in all physiographic provinces. Local extinctions are likely for the Olympic Peninsula and Oregon Coast Range Provinces.

# The Forests, Their Management, and Their Resources

---

## Forests and Timber Management

---

### Overview and Historic and Current Trends

Since the 1950's, a significant portion of the Nation's lumber needs have been met by timber harvests from the National Forest's Douglas-fir region. Douglas-fir is the primary framing and sheeting lumber used in construction in the western United States.

Numerous laws and policies direct timber management activities on National Forests, most of which direct the Forest Service to provide balanced resource management, protection and/or enhancement of a variety of forest values, and to maintain a healthy forest resource that will produce sustainable timber volumes. Forest Service policy stipulates that trees will not be harvested at a rate higher than can be sustained over time.

Most National Forests in the Douglas-fir region have recently completed Land and Resource Management Plans, or simply Forest Plans, a project that included assessing the complete mix of resources available from the Forests, and determining management activities for the planning area. Forest Plans provide for a mix of management activities on each Forest in order to meet local and national needs.

One of the main decisions of the Forest planning process is the amount of land to allocate to management prescriptions that include timber production and the corresponding wood volume expected to be produced on a sustained-yield basis.

Areas selected as suitable for timber production are those that are capable of producing industrial wood, can be adequately restocked, can be managed indefinitely without significant risk to related resource values such as soil productivity and water quality, and are not allocated to some other management objective that would preclude timber production.

Lands that meet the first three of these criteria are considered technically suitable for timber production. Lands that meet all four are termed selected suitable, or simply 'suitable'.

## *The Affected Environment and Environmental Consequences*

For the 17 National Forests included in this analysis, recently completed Forest Plans (or Draft Forest Plans) specify an average annual allowable sale quantity (ASQ) of 3,198 million board feet per year from 9,150,000 acres of lands suitable for timber production (Table 3&4 – 22).

**Table 3&4 – 22 Timber Production Acres and ASQ, Alternative A**

National Forest Admin Acres	Forested Acres	Technically Suitable Acres	Selected Suitable Acres	ASQ (MMBF/yr)
21,999,000	18,900,000	12,298,000	9,150,000	3,198

Actual harvest levels for the 10 years from 1981 to 1990 averaged 4,079 million board feet annually. Past harvest levels are typically from sales sold 1 to 4 years before harvest, and therefore vary from corresponding ASQs because of annual fluctuations in economic or supply conditions and more recently, a delay in the effect of reduced ASQs in recently completed Forest Plans. They are offered here for comparison purposes only, but demonstrate that Forest Plan allowable sale quantities are lower than previous ASQs and reflect a continued trend toward a more balanced mix of resource management objectives for the National Forests (Table 3&4 – 23).

**Table 3&4 – 23 Historic Harvest Levels from National Forests - Last 10 Years (millions of board feet per year)**

1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
3,222	2,056	3,707	4,179	4,348	4,502	5,153	5,261	4,931	3,434	4,079

## **Silvicultural Systems**

Clearcutting has been the cutting method of choice for much of the Douglas-fir volume harvested over the past 35 years since research discredited major partial cutting efforts done in the 1930's (Isaac, 1956). Other reasons for clearcutting include allowing sunlight to reach new seedlings to create optimum regeneration and growth conditions for shade-intolerant tree species, terrain too steep to allow equipment to work without damaging residual trees, damage from falling trees to the residual stand resulting from removal of typically heavy volumes, ease of dealing with competing non-conifer vegetation, the suppressed and old condition of many understory trees, the economics of various harvesting systems, slash disposal techniques, and reforestation efficiency.

Other cutting methods widely used include shelterwood and sanitation harvests. Shelterwood removes all but 8 to 20 overstory trees per acre to provide shelter and seed (although planting is common) for reforestation. In sanitation harvesting, trees that will soon be "lost" (from a timber production standpoint) to mortality or decay are

removed and the stand is typically thinned slightly to maintain health and vigor. Since the stand is left essentially stocked, no attempt is made to obtain new regeneration. Wherever stands are partially cut, the harvest method attempts to improve growth and stand genetics while working toward protecting the stand from insects, diseases, and fire.

Timber harvest has focused on mature and older stands because, as discussed in the modeling section, they offer a good opportunity for replacement with faster-growing young stands. At harvest rates scheduled under Forest Plans, remaining mature and old-growth stands are being harvested at about 0.7 of one percent per year. However, only about 50 percent of all mature and old-growth stands are on lands suitable for timber production and are ever scheduled for harvest. Young stands will continue to mature as existing scheduled stands are harvested.

Timber harvest activities generate receipts that pay for reforestation and other stand management activities such as removal of competing vegetation from conifer plantations, reduction of slash and other forest fuels, resource improvements for wildlife habitat or recreation, and construction of forest transportation systems.

Harvest prescriptions in recent years have emphasized techniques other than clearcutting in order to provide for the best mix of resource values and the least negative effects, such as those on visual resources. Slash burning is likewise being reduced in order to protect air, soil, and water quality. Uneven-age management is often considered a viable strategy, even on steep west-side slopes.

## Modeling Details and Technical Constraints

The allowable sale quantity (ASQ) is determined within the Forest planning process by using a variety of tools and decision-making steps. Generally, once those lands available for timber production have been selected and inventoried, an optimum harvest schedule and allowable harvest level can be determined with the help of the FORPLAN computer model. See Appendix B for a more detailed description of the model and how it was applied to this analysis.

The FORPLAN model applies a variety of constraints to simulate or approximate various resource objectives or standards. For instance, the dispersion constraint limits the amount of regeneration cutting that can be done within a given period of time. This constraint limits harvest levels to conform with the legal limit on harvest-created opening size.

One harvest schedule/ASQ relationship pertinent to this analysis is the relationship of suitable acres to ASQ. The Forest Service, in general, schedules annual harvest levels that can be maintained without decline over the long term (non-declining flow). This rate can be maintained if the planned schedule of harvests and regeneration is followed.

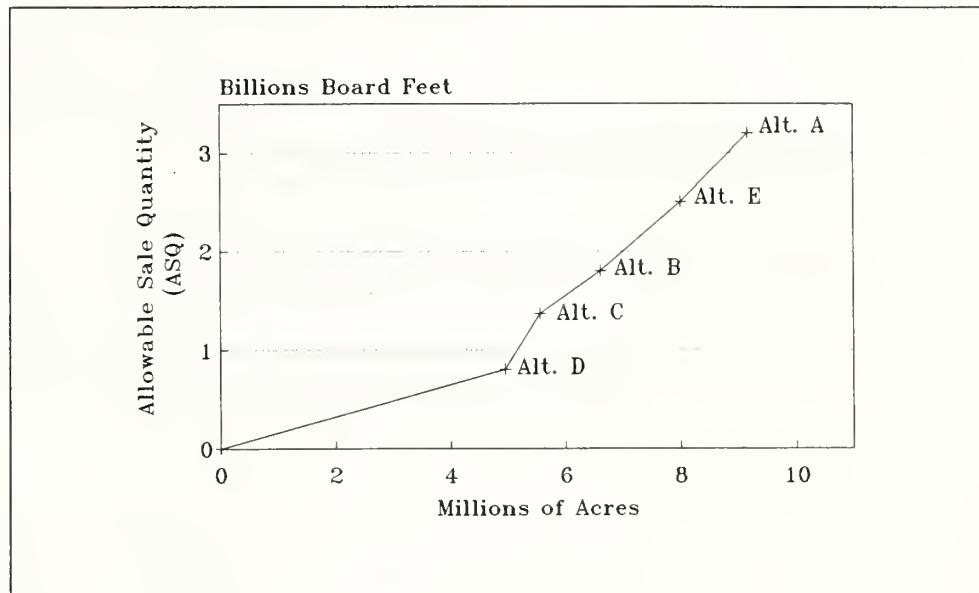
## *The Affected Environment and Environmental Consequences*

If the forest was well stocked with a uniform mix of age classes up to rotation age, and the only objective was wood production, harvesting would simply focus on the oldest age class in each decade and the harvest rate would match growth. The volume, type of stands harvested, and number of acres harvested would not vary from decade to decade. In such a case, a change in acreage would have a direct linear effect on ASQ.

In existing forests, however, there is an uneven mix of ages, tree numbers, and growth rates. Long-term timber harvest scheduling is not simply a process of harvesting a set acreage or stands of a certain age. The harvest schedule must optimize harvest dates relative to culmination of stand growth (or some other objective), meet or optimize all other resource constraints or objectives, and maintain harvest levels without decline on the long term. For determining a harvest schedule, these conditions are coupled with constraints that affect the various stand conditions differently; the 50-11-40 rule is a good example of this. See the discussion of 50-11-40 in Chapter 2 for more information. Economics and other considerations also vary by stand condition. When more acres are available there are more alternatives to make the harvest schedule more efficient, thereby increasing the harvest volume disproportionately more than the increase in acres.

Conversely, reductions in acreage available for harvest disproportionately reduces harvest volumes. For example, a 20 percent reduction in acres reduces ASQ by more than 20 percent. At greater acreage reductions, the effect is quite pronounced. Figure 3&4 – 14 shows this relationship between Alternatives A, B, C, D, and E. This same relationship was demonstrated in the 1988 Final Supplement to the Environmental Impact Statement for Oregon and Washington National Forests by the range of Alternatives A through L (combination of data from Tables IV-21 and IV-22, FSEIS). This effect is accentuated here also because the acres designated are, on average, higher volume acres, particularly in Alternative D.

**Figure 3&4 – 14 Relationship of Suitable Timber Acres to ASQ**  
 As suitable acres decline, ASQ declines faster, because of reduction in high volume acres, and because of reduced scheduling choices



## Relationship Between Owls and Harvest Levels

The 17 National Forests included in this analysis comprise the heart of the Douglas-fir region in the United States. While most nonfederal forest land in this region has been harvested at least once, these 17 Forests have approximately 14 million acres of forested land, including congressionally designated Wilderness that has not been harvested. Spotted owl habitat typically includes mature and old-growth forests. This is the same size class of trees most in demand for lumber and upon which the early decades harvest levels are based.

Thirty-nine percent of the nesting, roosting, and foraging habitat acres correspond with lands that are suitable for the production of timber. Under existing Regional Guide direction as defined in Alternative A, a network of Spotted Owl Habitat Areas are identified, containing approximately 722,000 acres of technically suitable timberland. Alternatives E, B, C, and D would contain additional suitable timberland.

On suitable timberlands outside designated areas managed primarily for spotted owl habitat, the 50-11-40 rule which is applicable in Alternatives B, C, and D, or the 40-20-40 rule and connecting habitat direction in Alternative E, will limit either the amount of area harvested, the type of harvest methods used, or both. This will have an additional effect on ASQ.

**The Standard and Guidelines for Each Alternative and the Effect on Harvest Levels**

Under Alternative A, timber management would continue as described by the individual Forest Plans. Approximately 722,000 acres of technically suitable timberlands in SOHAs would continue to be managed primarily for spotted owl habitat.

Under Alternatives B, C, and D, for the purposes of this analysis, no harvest is assumed in the designated areas managed primarily for spotted owl habitat.

Under Alternative E, no harvest is assumed in Deferred and Reserved Multiple-Pair Areas (MPAs). Research MPAs, although managed primarily for owl habitat, include limited scheduled timber harvest consistent with the research objective of studying the inter-relationship between silviculture and maintenance of owl habitat. For this reason, these acres are included in totals of acres suitable for timber production within this environmental impact statement.

For analysis it is assumed that timber harvest within Research MPAs will not reduce nesting, roosting, and foraging spotted owl habitat by more than 20 percent from levels that would be present if the areas were a Deferred MPAs. In fact, because of the option of using silviculture to manage fuels, insects and diseases, plus finding ways to silviculturally improve or create spotted owl habitat, levels of habitat in the Research MPAs might exceed habitat levels in Deferred MPAs in the long term.

Applicable to Alternatives B, C, and D, the ISC Report (Thomas et al. 1990, Appendix S: Silvicultural Experiments in Habitat Management) describes possible strategies for vegetation management within Habitat Conservation Areas. The report suggests that silviculturists and wildlife biologists could work together to meet objectives within management plans for Habitat Conservation Areas.

The potential treatments suggested in the ISC Report are consistent with recent trends toward New Perspectives and uneven-age management. Certainly in the long term, silvicultural treatments could be used to benefit spotted owl habitat which would result in harvest volume as well. At this time, however, such treatment strategies are only suggested as experimental in the ISC Report, and the ASQ analysis for this document assumes no harvests within designated areas managed primarily for spotted owl habitat.

Management of Connecting Habitat under Alternative E will also affect timber production. The requirement to maintain 30 to 50 percent of these areas in nesting, roosting, and foraging habitat will reduce harvest levels nearly 20 percent on the acres affected. This standard applies to corridors between Deferred and/or Reserved MPAs, on the Siuslaw National Forest within the Owl Management Zone, and in California to all National Forest lands outside of MPAs.

The remaining standard and guideline that has a significant effect on timber production is the 50-11-40 rule for Alternatives B, C, and D (and the similar 40-20'-40 rule for Alternative E, discussed below). Forests must be managed to maintain or achieve a condition where at least 50 percent of the area must have 40 percent canopy closure (or greater) in trees 11 inches or more in diameter. In the short term, this requirement can be very limiting where a high percentage of the forest has been partially cut, where commercial timber sites can barely support 40 percent canopy closure, or where plantations with trees under 11 inches in diameter are approaching 50 percent of the area.

Since the requirement is applied to quarter townships, or approximately 5,760-acre units, forests meeting the condition on the average will still find some scheduled harvest areas constrained.

If a forest was in a regulated condition of having an equal number of acres in each age class, with the oldest age class at least twice that necessary to grow 11 inch diameter trees, this constraint would have no effect. However, most forests will not approach that condition for at least several decades.

Proposals are being prepared, under the Adaptive Management Process described in Appendix R of the ISC Report (Thomas et al. 1990), to adjust the 50-11-40 rule in California and possibly the east side of the Cascade Range to some smaller percentage, either in percent of area or percent canopy closure.

In northern California National Forests, it is estimated that the 50-11-40 rule portion of the ISC Strategy reduces the ASQ by more than 100 million board feet. If it is determined, through the ISC's adaptive management process, that the dispersal habitat qualities of the Forest Matrix could be maintained at some lower standard, the ASQ could rise.

For Alternative E the 40-20'-40 rule applies to most land in National Forests in the Cascades and in the Klamath Mountains of Oregon. This rule requires maintenance of 40 percent canopy cover over 40 percent of the area, with the bottom of the crowns averaging at least 20 feet above the forest floor to allow room for owls to fly.

The 40-20'-40 rule is expected to have almost the same effect on ASQ as the 50-11-40 rule. First, managed stands generally will not self-prune to a height of 20 feet before diameters reach 11 inches. Secondly, most of the quarter townships affected by the 50-11-40 rule are not in the borderline 40 to 50 percent category. Most constrained areas remain constrained even at this lower standard.

## **Effects of the Alternatives on Timber Production**

### **Short-term Effect on Fiscal Years 1992 and 1993 Sales**

Since timber sales take several years to plan and prepare, a major change in acres available for timber production will affect short-term timber sale plans differently than the effect on ASQ. That is, if 1992 or 1993 timber sales are being planned even partially on lands that will be designated areas managed primarily for spotted owl habitat, those sales will be modified or not offered as planned. This has a detrimental effect on the mills and communities dependent on supply of timber from National Forests. Because Forests began planning timber sales consistent with the ISC Strategy in 1990, Alternative B would have little or no effect. Selection of Alternative E would have little effect since most of the designated areas are within HCAs. Selection of Alternative C would have some affect, and Alternative D, because it includes lands spread over much of the affected Forests, would result in a decline in 1992 and 1993 sale offerings substantially more than the decline in ASQ.

### **Effect on Existing Sales**

The ISC Conservation Strategy includes direction to modify sales or sale units that are within 1/2 mile of owl pairs. This direction applies to sale units within HCAs at the time of adoption of the ISC Strategy. There may be sold but unharvested sales which are not in compliance with this direction. The effect could be greater under Alternative C, and much greater under Alternative D. The extent and disposition of affected sales will be determined when an alternative has been selected.

### **Effect of Designating Spotted Owl Habitat in Lands Suitable for Timber Production**

The effect on timber supplies of designated areas to be managed primarily for spotted owl habitat is directly related to the amount of suitable timber acres included in the designated areas. The effect of designation is to reduce the acres selected for timber production from 9,150,200 acres to 4,951,900 acres across the alternatives (Table 3&4 – 24).

**Table 3&4 – 24 Forested Acres Suitable for Timber Production (in thousands)**

National Forests	Forested <sup>1</sup>	Technically <sup>1</sup> suitable	Alt A selected <sup>1</sup> suitable <sup>2</sup>	Alt B selected <sup>2</sup> suitable	Alt C selected <sup>2</sup> suitable	Alt D selected <sup>2</sup> suitable	Alt E selected <sup>2</sup> suitable
<b>Washington</b>							
Olympic	583.8	446.9	352.1	177.4	134.1	145.3	356.2
Mt. Baker-Snoqualmie	1301.4	597.3	346.4	102.2	119.9	64.7	301.8
Gifford Pinchot	1161.8	946.9	676.5	426.6	336.9	257.7	547.5
Okanogan <sup>3</sup>	1487.3	703.2	541.9	477.4	529.5	519.9	542.9
Wenatchee	1451.1	791.9	576.1	377.3	349.1	259.8	567.0
WA Subtotal	5985.4	3486.2	2493.0	1560.9	1469.5	1247.4	2315.4
<b>Oregon</b>							
Siuslaw	581.5	537.7	369.0	208.9	139.6	113.2	286.4
Mt. Hood	948.9	678.5	385.8	283.2	264.6	175.6	391.2
Willamette	1504.5	1032.1	715.1	471.6	396.1	219.8	657.9
Umpqua	904.6	729.0	621.1	505.2	441.3	260.0	579.0
Deschutes <sup>3</sup>	1419.8	1150.9	841.1	787.6	778.3	726.9	856.8
Winema <sup>3</sup>	1002.3	825.4	713.6	707.3	696.8	682.4	713.7
Rogue River	560.7	390.8	315.0	193.0	216.3	110.0	227.6
Siskiyou	1037.1	616.0	510.0	411.0	363.1	246.0	468.3
OR Subtotal	7959.4	5960.4	4470.7	3567.8	3296.1	2533.9	4180.9
OR & WA Subtotal	13945.3	9446.6	6963.7	5128.7	4765.6	3781.3	6496.3
<b>California</b>							
Shasta-Trinity	2009.8	1077.3	859.0	611.4	585.5	530.4	825.3
Klamath	1406.9	1011.4	675.0	614.3	568.9	361.4	611.1
Mendocino	621.9	343.4	270.0	210.4	191.7	152.8	239.7
Six Rivers	924.3	419.3	382.5	183.1	163.3	126.0	376.1
CA Subtotal	4962.9	2851.4	2186.5	1619.2	1509.4	1170.6	2052.2
<b>Total All Forests</b>	<b>18907.7</b>	<b>12298.0</b>	<b>9150.2</b>	<b>6747.9</b>	<b>6275.0</b>	<b>4951.9</b>	<b>8548.5</b>

<sup>1</sup>Acres forested, technically suitable, and Alternative A selected suitable acres taken from each National Forest's Land and Resource Management Plan in Washington and Oregon, and current inventory in California.

<sup>2</sup>'Selected Suitable' are the acres scheduled for some level of timber production within the alternative, and excludes acres allocated to other uses by Forest Plans and allocated to spotted owls. Alternative E includes "Research" areas because some harvests are expected.

<sup>3</sup>Acres are Forest totals and include areas in and out of the range of the spotted owl.

## *The Affected Environment and Environmental Consequences*

The area managed for timber production ranges from 48 to 26 percent of the 18,900,800 forested acres on the 17 National Forest included in the ASQ analysis and 74 to 40 percent of the area technically suitable for timber production. The area managed for timber production excludes 61 to 100 percent of the existing spotted owl nesting, roosting, and foraging habitat (Table 3&4 – 25).

**Table 3&4 – 25 Area to be Managed for Timber Production**  
Area to be managed for timber production and percent of spotted owl nesting, roosting, and foraging habitat not scheduled for timber production.

Alter-native	Acres to be managed for timber production	Percent of technically suitable acres managed for timber production	Percent of all forested lands managed for timber production	Percent of nesting, roosting, and foraging acres not scheduled for timber production
A	9,150,200	74	48	61
B	6,747,900	55	36	74
C	6,275,000	51	33	80
D	4,951,900	40	26	100
E	8,548,500	70	45	66

## **Estimated Allowable Sale Quantity (ASQ):**

The estimated allowable sale quantities (ASQ) for the 17 National Forests included in this analysis range from 3,198 million board feet annually under Alternative A, to 809 million board feet annually under Alternative D (Table 3&4 – 26). The allowable sale quantity for Alternative A forms the basis for comparing the ASQ of the other alternatives. This is because Alternative A represents existing Forest Plans and/or Regional Guide direction. Alternatives B, C, D, and E reduce ASQ by 43 percent, 58 percent, 52 percent, 75 percent, and 23 percent respectively, from Alternative A.

The final Multi-Resource Strategy document was received December 9, 1991, after Alternative E analysis was begun. This final document contained numerous minor changes that, in aggregate, would likely lower the ASQ from those displayed in the following table by around 10 percent.

**Table 3&4 – 26 First Decade Timber Program**

Estimated average annual allowable sale quantity (ASQ) and percent change from Alternative A. (million board feet)

	Alternative A ASQ	Alternative B ASQ (%chng)	Alternative C ASQ (%chng)	Alternative D ASQ (%chng)	Alternative E ASQ (%chng)
Olympic	111	20 (-82%)	15 (-86%)	14 (-87%)	112 (+01%)
Mt. Baker-Snoqualmie	108	32 (-70%)	27 (-75%)	20 (-81%)	68 (-37%)
Gifford Pinchot	334	166 (-50%)	131 (-61%)	34 (-90%)	221 (-34%)
Okanogan	63	56 (-11%)	56 (-11%)	56 (-11%)	63 0
Wenatchee	136	54 (-60%)	50 (-63%)	26 (-81%)	100 (-26%)
WA Subtotal	752	328 (-56%)	279 (-63%)	150 (-80%)	564 (-25%)
Siuslaw	335	172 (-49%)	115 (-66%)	58 (-83%)	236 (-30%)
Mt. Hood	189	138 (-27%)	84 (-56%)	85 (-55%)	122 (-35%)
Willamette	491	275 (-44%)	213 (-57%)	105 (-79%)	370 (-25%)
Umpqua	334	263 (-21%)	230 (-31%)	31 (-91%)	290 (-13%)
Deschutes	100	73 (-27%)	72 (-28%)	59 (-41%)	98 (-02%)
Winema	117	117 0	114 (-03%)	100 (-15%)	116 (-01%)
Rogue River	120	50 (-58%)	45 (-63%)	22 (-82%)	73 (-39%)
Siskiyou	160	126 (-21%)	109 (-32%)	10 (-94%)	144 (-10%)
OR Subtotal	1846	1214 (-34%)	982 (-47%)	470 (-75%)	1449 (-22%)
OR & WA Subtotal	2598	1542 (-41%)	1261 (-51%)	620 (-76%)	2013 (-23%)
Shasta-Trinity	224	85 (-62%)	78 (-65%)	66 (-71%)	116 (-48%)
Klamath	142	103 (-27%)	96 (-32%)	65 (-54%)	145 (+02%)
Mendocino	84	25 (-70%)	23 (-73%)	17 (-80%)	70 (-17%)
Six Rivers	150	68 (-55%)	67 (-55%)	41 (-73%)	113 (-25%)
CA Subtotal	600	281 (-53%)	264 (-56%)	189 (-69%)	444 (-26%)
<b>Total All Forests</b>	<b>3198</b>	<b>1823 (-43%)</b>	<b>1525 (-52%)</b>	<b>809 (-75%)</b>	<b>2457 (-23%)</b>

Alternative A ASQ from each National Forest's Land and Resource Management Plan (see California Alternative A Models in Appendix B).

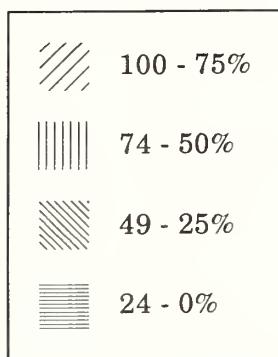
Alternatives B through E ASQ based on analysis done for this document, generally using individual Forest FORPLAN models.

Alternative E ASQ could be overstated by 10 percent because of changes to the strategy.

## Figure 3&4 – 15

### Alternative B

#### Allowable Sale Quantity as a Percent of Alternative A



##### Washington National Forests:

Olympic	18%
Mt. Baker-Snoqualmie	30%
Gifford Pinchot	50%
Okanogan	89%
Wenatchee	40%

Washington Total 44%

##### Oregon National Forests:

Siuslaw	51%
Mt. Hood	73%
Willamette	56%
Umpqua	79%
Deschutes	73%
Winema	100%
Rogue River	42%
Siskiyou	79%

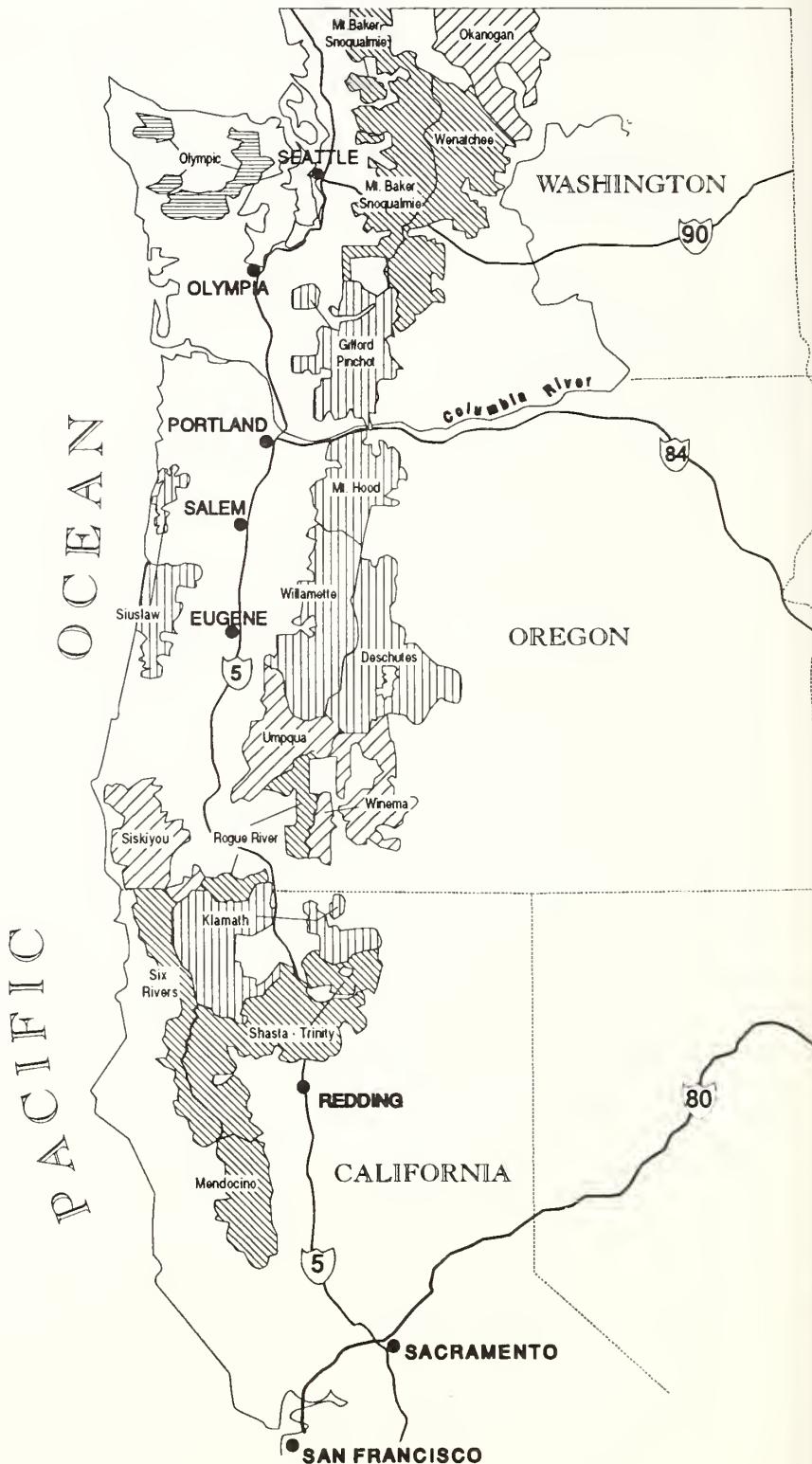
Oregon Total 66%

##### California National Forests:

Shasta-Trinity	38%
Klamath	73%
Mendocino	30%
Six Rivers	45%

California Total 47%

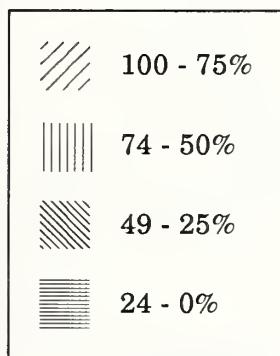
Range Total 57%



## Figure 3&4 – 16

### Alternative C

#### Allowable Sale Quantity as a Percent of Alternative A



#### Washington National Forests:

Olympic	14%
Mt. Baker-Snoqualmie	25%
Gifford Pinchot	39%
Okanogan	89%
Wenatchee	37%

Washington Total 37%

#### Oregon National Forests:

Siuslaw	34%
Mt. Hood	44%
Willamette	43%
Umpqua	69%
Deschutes	72%
Winema	97%
Rogue River	37%
Siskiyou	68%

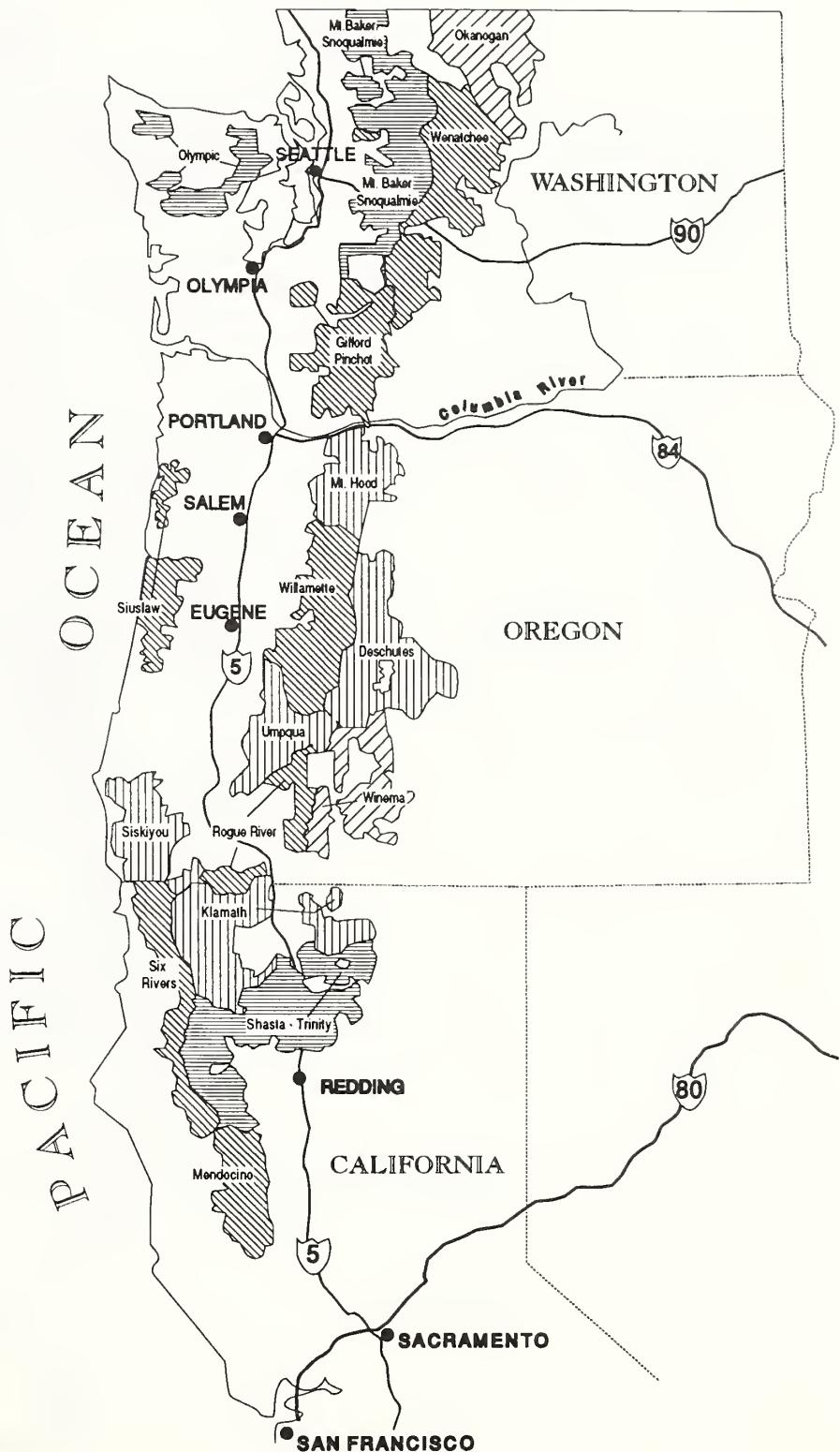
Oregon Total 53%

#### California National Forests:

Shasta-Trinity	35%
Klamath	68%
Mendocino	27%
Six Rivers	45%

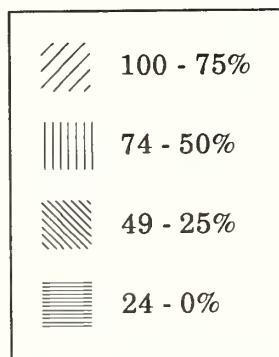
California Total 44%

Range Total 48%



## Figure 3&4 – 17 Alternative D

### Allowable Sale Quantity as a Percent of Alternative A



#### Washington National Forests:

Olympic	13%
Mt. Baker-Snoqualmie	19%
Gifford Pinchot	10%
Okanogan	89%
Wenatchee	19%

Washington Total 20%

#### Oregon National Forests:

Siuslaw	17%
Mt. Hood	45%
Willamette	21%
Umpqua	9%
Deschutes	59%
Winema	85%
Rogue River	18%
Siskiyou	6%

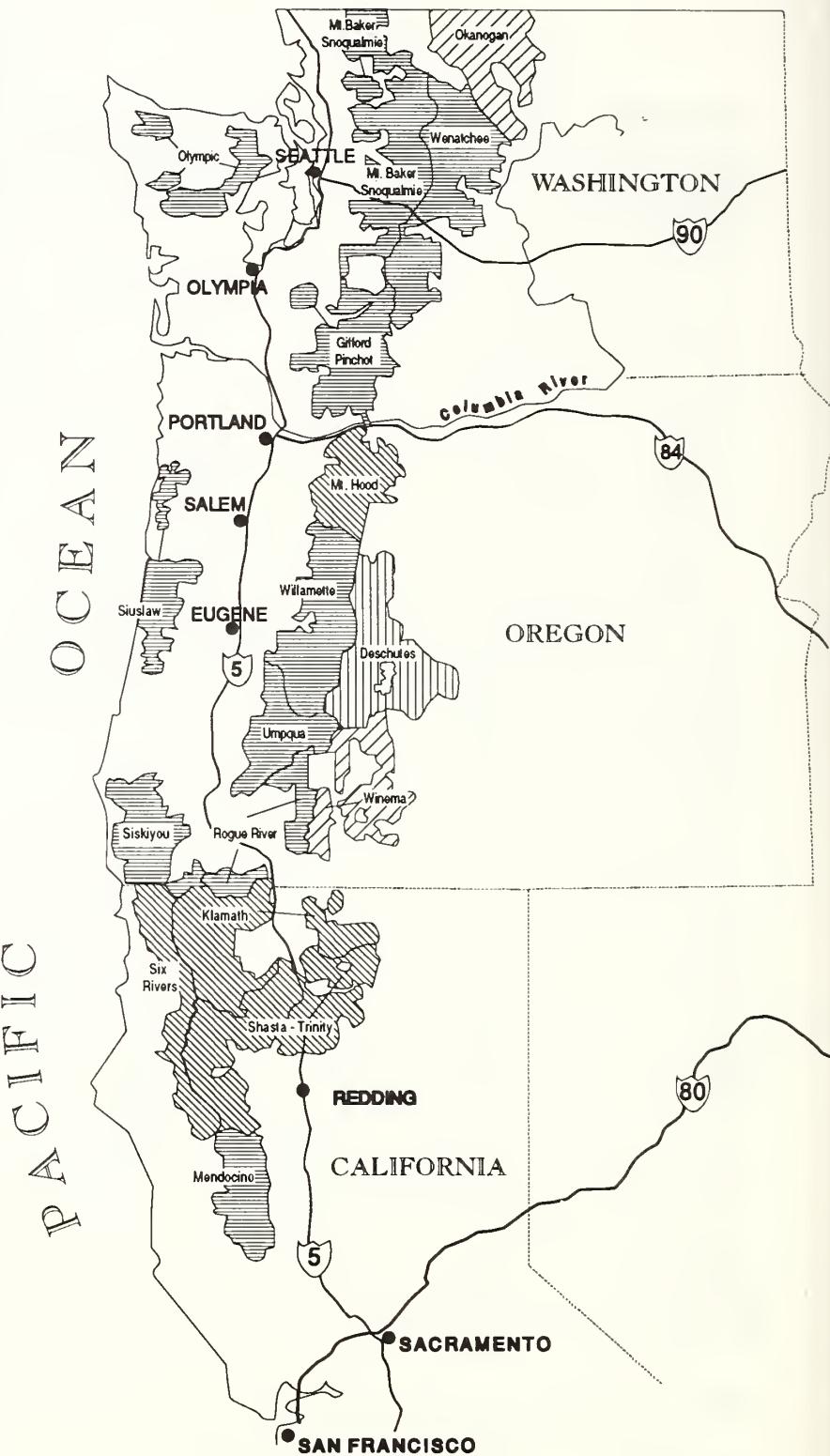
Oregon Total 25%

#### California National Forests:

Shasta-Trinity	29%
Klamath	46%
Mendocino	20%
Six Rivers	27%

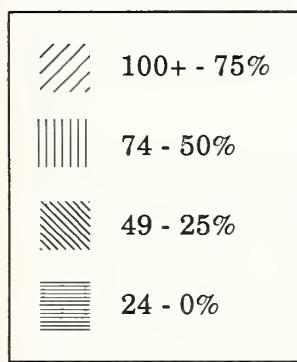
California Total 31%

Range Total 25%



## Figure 3&4 – 18 Alternative E

## Allowable Sale Quantity as a Percent of Alternative A



## Washington National Forests:

Olympic	101%
Mt. Baker-Snoqualmie	63%
Gifford Pinchot	66%
Okanogan	100%
Wenatchee	74%

Washington Total 75%

## Oregon National Forests:

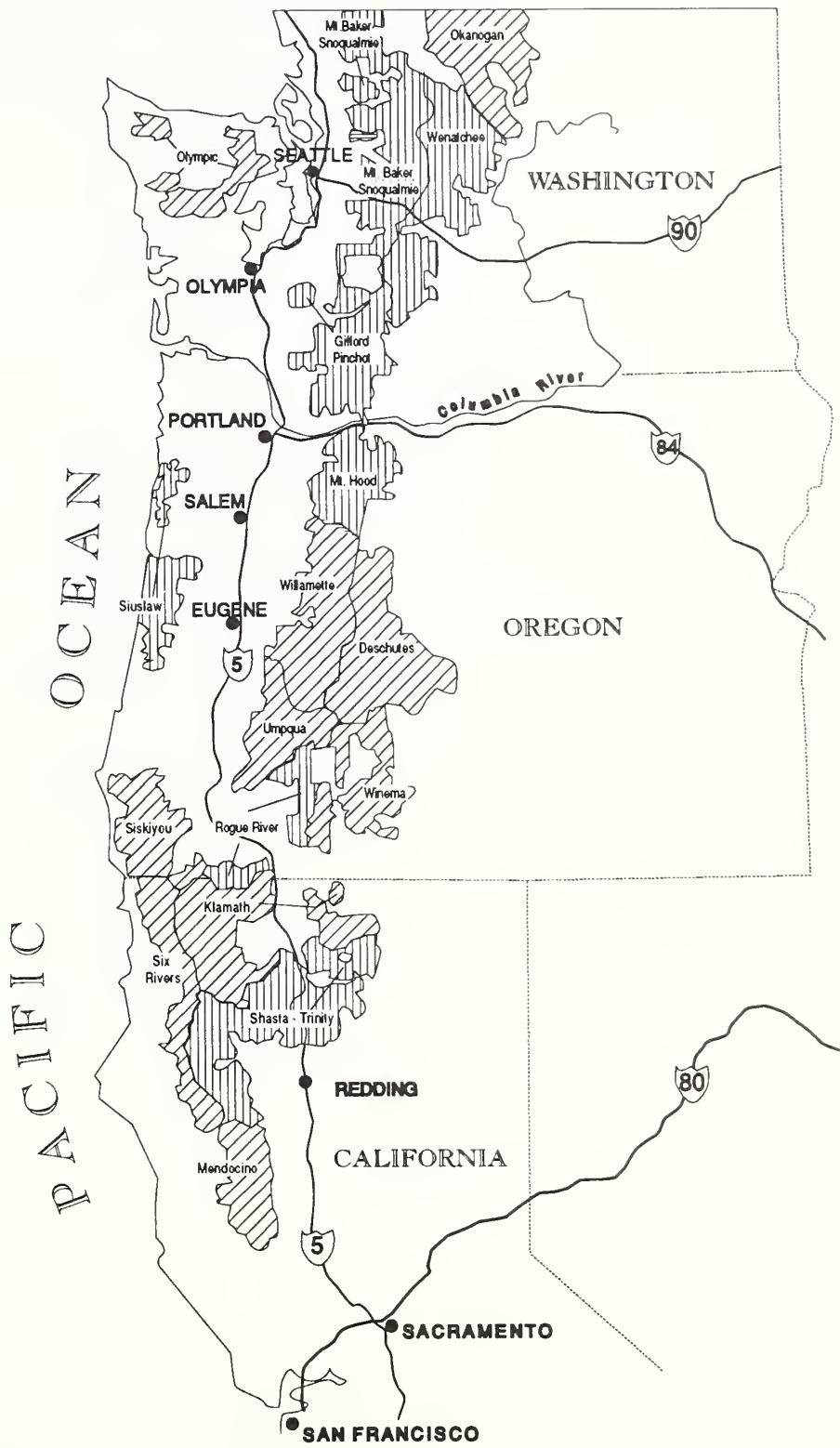
Siuslaw	70%
Mt. Hood	65%
Willamette	75%
Umpqua	87%
Deshutes	98%
Winema	99%
Rogue River	61%
Siskiyou	90%

Oregon Total 78%

California National Forests:	
Shasta-Trinity	52%
Klamath	102%
Mendocino	83%
Siskiyou	75%

### California Total 5187

Range Total 77%



### **Effect on ASQ of the 50-11-40 and 40-20'-40 Rules**

The House of Representative's Scientific Panel on Late-Successional Forest Ecosystems reported on July 24, 1991, that land management agencies, "...have found that the '50-11-40' rule is more binding on timber harvest than initially expected especially where... partial cutting led to (lower) stocking on large acreage (eastern Washington and Oregon, northern California)" (Johnson et al. 1991).

Overall, the 50-11-40 requirement in Alternative B affects first decade ASQ by 320 million board feet, or 10 percent of the Alternative A ASQ. The estimated effect on individual Forests (Figure 3&4 - 19) is up to 40 percent where various partial cutting systems have been used or, as in parts of northern California, where site productivity is lower than in the Oregon and Washington portion of the spotted owl's range.

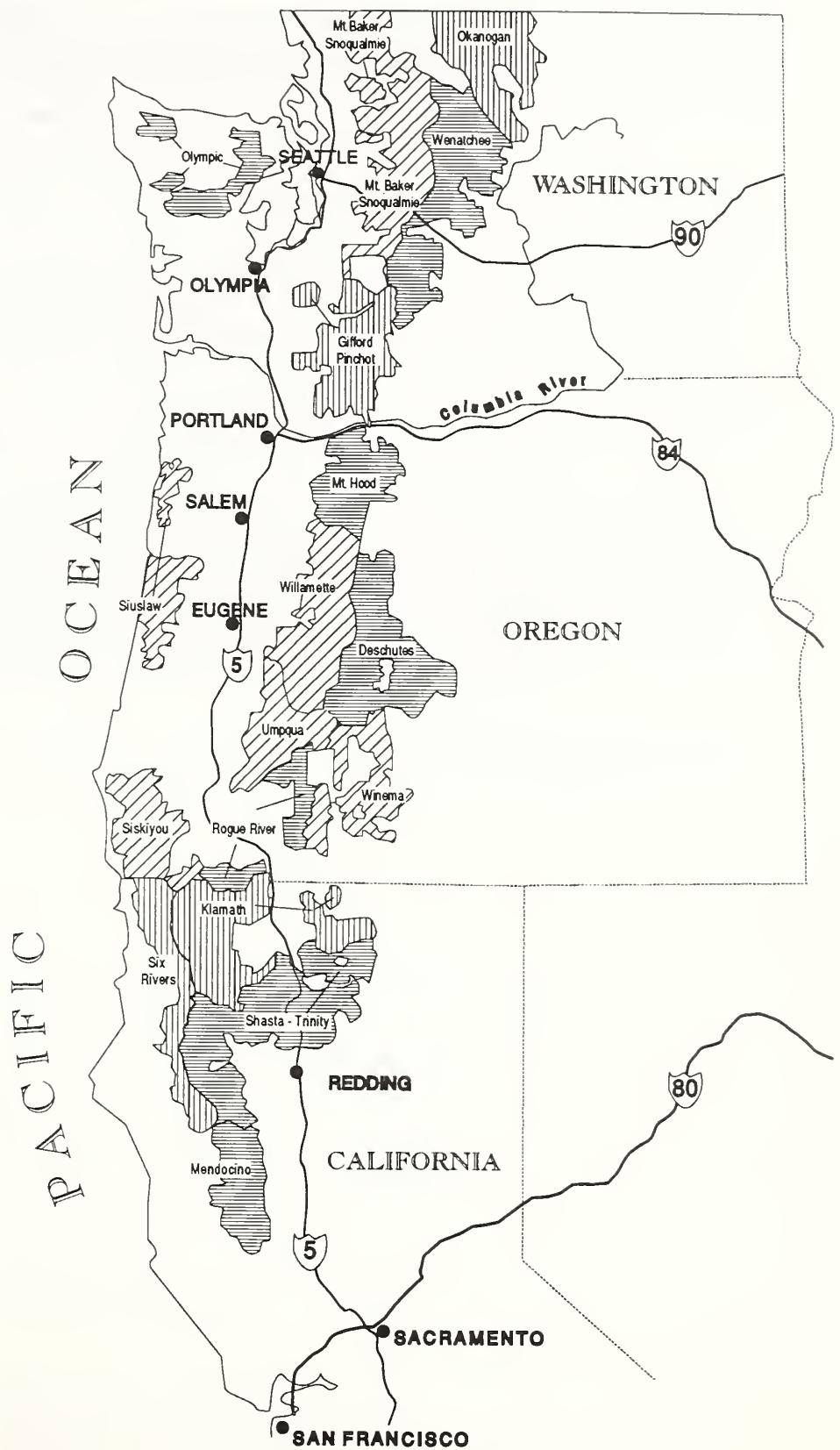
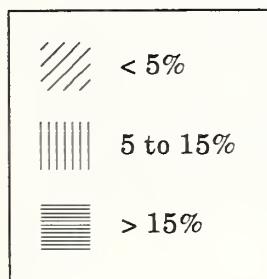
In several cases the effect of the 50-11-40 requirement on ASQ is double the effect of designating Habitat Conservation Areas. However, on some high site class forests where most stands meet the standard now, the 50-11-40 requirement can be maintained with little or no change in management, because regeneration-cut acres are continually replaced with young stands reaching the 11 inch standard around age 30 or 40.

The effect of the 50-11-40 requirement on the first decade ASQ is nearly the same for Alternative C as for Alternative B; it affects ASQ about 300 MMBF, or 10 percent of Alternative A's ASQ. For Alternative D the reduction is less, because the already "designated" 1.8 million acres of suitable timber outside of Habitat Conservation Areas, often in scattered smaller parcels, contributes to meeting the 50-11-40 requirement.

As noted previously, the effect of the 40-20'-40 rule in Alternative E is very similar to 50-11-40. Because the 40-20'-40 rule only applies within certain portions of the Owl Management Zone, generally the Cascade Forests in Oregon and Washington and the Klamath Mountains in Oregon, the effect is to reduce ASQ approximately 150 MMBF when compared to Alternative A.

Figure 3&4 – 19  
Alternatives B  
and C

Effect of  
50-11-40 Rule  
on ASQ  
Expressed as a  
Percentage of  
Alternative A  
ASQ



### **Silvicultural Implications**

Designation of more areas managed primarily for spotted owl habitat will tend to reserve the larger diameter and heavier volume stands, which will have a marked effect on the types of forest products produced and the cost of logging and milling. Therefore, it will also affect the economic viability of some timber sales, and associated reforestation, roads, and resource improvement projects which would be supported with timber sale receipts.

There will also be a more abrupt shift to more small tree management including commercial thinning, and final removal in past partially cut areas. Products requiring larger, fine-grained, older Douglas-fir, and mills designed to handle them, will be most affected.

Thousands of acres of existing plantations within designated areas managed primarily for spotted owl habitat will continue to need cultural treatments such as thinning and release if they are to continue to grow at optimum rates to meet the new objective of growing future owl habitat. The exclusion of timber management in these areas will eliminate new sources of Knutson-Vandenberg funding (timber sale receipts available for reforestation and other cultural work) for such management. Continuation of this work would require other more limited funding sources, such as wildlife habitat improvement funds.

## Fragmentation of Suitable Timberlands in Alternative D

The economic and operational feasibility of timber sales in Alternative D, with high fragmentation of the designated area managed primarily for owl habitat because this alternative includes all owl habitat, may not be adequately reflected in the ASQ figures because FORPLAN is not a spatial model.

There are two issues here. One is the desirability of avoiding road construction in spotted owl habitat since, under this alternative, it is all included within designated areas managed primarily for spotted owl habitat. The other is that with 20 to 40 percent (or more) of an area and all of the larger diameter, high volume stands unavailable for harvest, many areas will not support the cost of building and maintaining roads. The result will be that, at least in some areas, a larger “gross” area will become unavailable for timber production rather than just the highly fragmented designated areas in this alternative.

This fragmentation could have a substantial effect on new road construction. The ISC Report states, “Road construction in HCAs is discouraged because it detracts from the quality and amount of owl habitat. Roads should be located in HCAs only when no feasible alternative is possible. When roads are constructed in HCAs, they should be located and engineered to minimize the loss and alteration of habitat...” (Thomas et al. 1990: 30).

Clearly road construction to the remaining parcels would at least be subject to the additional expense and effort of additional analysis and sometimes longer routes.

## Limited Opportunities to Mitigate ASQ Effects Through More Intensive Management

### More Intensive Management

Designation of areas to be managed primarily for owl habitat will affect the amount of land from which timber can be harvested. Although there have been some predictions that more intensive management on the remaining lands could at least partially offset the losses, and although there is some opportunity for commercial thinning and other silvicultural treatments to increase volumes of smaller diameter material, most National Forest suitable timberlands are already programmed for a proper balance of intensive timber and non-timber resource management. The ASQ estimate for Alternative A is already based on timely execution of scheduled treatments such as reforestation, release, and thinning. Failure to complete these treatments will result in failure to meet planned harvest goals. It is unlikely that major additional opportunities for intensification exist (Johnson et al. 1989).

Opportunities to mitigate ASQ reductions through modification of FORPLAN modeling constraints have also been considered. These constraints exist to model such things as dispersion of cutting units,

## *The Affected Environment and Environmental Consequences*

limited harvest acreage within watersheds or visually sensitive areas, maintenance of seral stage diversity and snags, etc. The opportunity to increase ASQ by reducing resource protection exists, but could result in unacceptable resource effects, such as in the case of visually sensitive areas and watershed constraints, or with activities inconsistent with the National Forest Management Act, as in the case of harvest dispersion constraints.

Uneven-age management could represent an opportunity to meet the 50-11-40 requirement continuously within a stand while managing for timber production, and there is some opportunity for this. However, two factors limit this opportunity:

1. where the 50-11-40 requirement is binding, many stands have already been partially cut. Although intensive efforts could convert or maintain many of these stands to uneven-aged management, the canopy closure for 11 inch and larger trees is already at 40 percent or below; and,
2. uneven-age management has not been heavily used on the west side of the Cascade Range because of steep terrain, heavy understory vegetation, older-aged stands, and heavy damage to residual stocking during removal of large volumes of large diameter trees.

Extensive trials have shown that the selection method used in uneven-aged management cannot be applied successfully to old-growth coast Douglas-fir (Williamson and Twombly 1983; Isaac 1956).

## Pacific Yew (*Taxus Brevifolia*)

---

### Introduction

Of recent interest to maintenance of late-successional forests in the Pacific Northwest is conservation of the Pacific yew tree. The presence of taxol, an anti-cancer agent in the tree's bark and needles, has created a high and competitive demand for Pacific yew. The Pacific yew is closely associated with late-successional forests throughout its range (Marcot, Pers. comm.; Spies 1991), or in riparian areas because of infrequent fire history.

Harvesting under Alternative A may total between 200,000 and 450,000 of the estimated 29 million Pacific yew trees within the range of the northern spotted owl within the next 5 years.

### Environmental Consequences

There are two main concerns relating to the effects on Pacific yew from the alternatives addressed in this document: the way the alternatives affect the ability to provide yew bark for taxol production, and the way the alternatives help maintain the genetic viability of this species in its environment.

#### 1. Providing Sufficient Amounts of Yew Bark.

Alternative A provides the most timber harvesting of all the alternatives and thus would increase accessibility to Pacific yew populations in the first decade. Those alternatives that set aside increasing amount of old-growth habitat by restricting timber harvest would increasingly inhibit bark-gathering activity because of the lack of open roads serving Pacific yew areas. Alternative D would provide the lowest probability of meeting the yew bark demand.

#### 2. Maintaining Genetic Viability and Diversity of Yew.

Alternative A, with the highest planned level of timber harvest would impact the yew populations the most, and therefore have the lowest probability of maintaining the genetic and ecological viability in its range. This is assuming that timber harvest itself will reduce populations of Pacific yew by reducing the surrounding old-growth habitat.

With decreasing timber harvest proposed in Alternatives E, B, C, and D, respectively, the probability of meeting the concern for genetic viability of yew increases. The long-term concern for yew populations would be best met by Alternative D because it would provide for the most functional, late-successional forest.

Future management of Pacific yew is the subject of a separate environmental impacts statement now being prepared. Pacific yew is discussed in more detail in Appendix I.

## Insects and Diseases

---

### Overview and Trends

While an abundance of organisms inhabit the forests of the Pacific Coast States, just a few are considered to have major ecological implications for current management of National Forests. A number of organisms confound human expectations by causing foliage loss, branch and stem loss, wood decay, and tree mortality which, depending on the magnitude, may result in significant shifts in species composition, changes in stand structure, or the creation of various-sized forest openings. These effects may be negative or positive depending on management objectives. In designated areas managed primarily for owl habitat, where the management objective is to protect populations of the northern spotted owl, maintenance of nesting, roosting, and foraging spotted owl habitat is viewed as being of critical importance. Insect and disease effects on spotted owl habitat could be substantial.

### Consequences

The kinds of insect and disease effects are estimated to be essentially the same under Alternatives A, E, B, C, and D, but amounts of area affected will be progressively greater, respectively, and differ among provinces. Insect and disease effects on spotted owl nesting, roosting, and foraging habitat could be substantial in the dryer portions of the range east of the Cascades and in the Klamath Province. In the absence of special preventative treatments, long-term retention of owl habitat in the dryer portions of the range appears doubtful.

Because of fire suppression, there is a gradual shift from shade-intolerant to shade-tolerant species which tend to be more susceptible to insects and diseases. Also, higher levels of tree mortality occur during drought periods in many overstocked stands. This by itself may not be deleterious to spotted owl habitat, but often the increased fuels result in catastrophic wildfires, as in 1987, that dramatically alter habitat over large areas for many decades.

### Mitigation

Spotted owl habitat might be maintained and created with some management activities. Stocking control appears to be the most effective method available to retain spotted owl habitat; silvicultural treatments might be appropriate.

## **Port-Orford-Cedar Root Disease**

**Overview and Trend.** Port-Orford-cedar is a highly valued forest tree species whose commercial production is threatened by a root disease. The disease moves from tree to tree through root grafting and to new locations, as resting spores in moist soil that attach to vehicles, humans or grazing animals, and as swimming spores that move with overland flow of water. Infection occurs at the root tip and, over time, the fungus colonizes the root system and kills the tree. Numerous regulatory, suppression, and prevention activities are conducted under an existing Port-Orford-cedar Action Plan (USDA, unpublished). One such activity essential to overall control of the disease is removal of host trees to reduce or prevent the spread of the disease.

**Consequences.** In infected drainages, those alternatives limiting Port-Orford-cedar management, including salvage, within designated areas managed primarily for spotted owl habitat will result in continued mortality in infection centers within these areas and the potential for increased spread of the disease. This problem is greatest in alternatives with the largest number of infected acres designated, and especially in Alternative D where the fragmented designated areas managed primarily for spotted owl habitat are more likely to become infected by upslope human activity. Reduced construction and maintenance of roads and other management activities in Alternatives E, B, and C, respectively, will reduce the number of new infection centers.

Reduced access due to decreased roading and equipment use decreases the likelihood of new infections. This benefit is progressively higher for uninfected areas in Alternatives E, B, and C, respectively.

Insect and disease management is discussed in more detail in Appendix G.

## **Fire and Fuels Management**

---

### **Overview and Trends**

All vegetation types in the spotted owl range have evolved with fires of natural or human-caused origin. The frequency and intensity of fire over time varies greatly over the landscape, and because of variation in fuel and weather. A combination of fire effects can occur in any stand depending on the key variables of climatic conditions, fuels, and topography. This can result in a mosaic of vegetation.

Fire suppression during this century has created unexpected side effects. Successful fire suppression and lack of vegetation management can result in considerable buildup of natural fuels, thereby increasing rates of fire spread and intensity and increasing the probability of a stand replacement fire.

Management activities can either increase or decrease the risk to spotted owl habitat from hazardous fuels. Management prescriptions can include requirements to remove, burn, rearrange, chip, crush or otherwise modify dead and down fuels to reduce fire hazards that had increased due to management activities. Such modifications decrease fire intensity and rate of spread and increase suppression efficiency.

### **Environmental Consequences**

With continued fire suppression there will probably be a significant increase in large-stand replacement fires if no management activities are employed to reduce fuel buildup. Fire history suggests that in the absence of all vegetation management within and adjacent to Habitat Conservation Areas, those alternatives with the least vegetation management, such as Alternative D, would have the most large-stand replacement fires.

Fire and fuels management is discussed in more detail in Appendix F.

## Old-Growth Forests

---

### Introduction

Concern about the future of old-growth stands has risen sharply over the last few years. Old growth is now valued for its contribution to ecological diversity, recreation, scientific, wildlife habitat, and aesthetic qualities. Many believe that old-growth forests are declining too rapidly.

Others value old-growth forests as a source of timber, contending that enough old growth has already been designated for preservation through "reserved" lands. There is also concern that in many of these stands, decay and mortality actually exceed growth, and timber value is being lost.

Because the habitat requirements of the northern spotted owl are usually found in old-growth forests (Thomas et al. 1990), the alternatives in this environmental impact statement that maintain the most spotted owl habitat also tend to maintain the most old-growth forests.

### Current Situation and Trends

Old-growth forests are ecosystems distinguished by old trees and the structural attributes they create. Old-growth forests encompass the latter stages of stand development that typically differ from younger stages in a variety of characteristics. These may include tree size, accumulation of large dead woody material, number of canopy layers, species composition, and ecosystem function.

The age at which old-growth forests develop and the specific structural attributes that characterize old-growth forests will vary widely according to forest type and other factors. In the Douglas-fir forests of western Washington and Oregon, and of northern California, old-growth forest characteristics begin to develop between 150 and 250 years of age.

The Douglas-fir region was never entirely comprised of old-growth forests. Explorers and pioneers were confronted by a rich mosaic of young and old forests brought about chiefly by fires that raged unchallenged. As settlers began clearing land and utilizing the resource, they started from the low-lying coastal and river areas and worked their way inland where the desirability of the land for farming became increasingly less, and the difficulty of logging became increasingly greater. The slopes of the Cascade Range, now mostly National Forests, were the last to be encountered. Consequently, together with National Parks and other public lands, National Forests contain most of today's old-growth resource.

## *The Affected Environment and Environmental Consequences*

The Regional Guide for the National Forests in Oregon and Washington states that old-growth stands contain mature and overmature trees in the overstory and are well into the mature-growth stage. Old-growth stands will usually contain a multilayered canopy and trees of several age classes. Standing dead trees and down material are present, and evidence of human activities may be present, but may not significantly alter other characteristics.

Individual National Forests estimated the acres of old-growth resources using all available information. An inventory of structural characteristics contained in the definition was usually not available, but best estimates based on available data were used for the development of Forest Plans. This estimate was the basis for determining the extent of old-growth forests which would be managed to retain their unique ecosystem character, and the extent of old-growth forests which would be suitable for timber production.

The positive correlation between nesting, roosting, and foraging habitat and old-growth forests means that the alternatives in this analysis will affect old-growth forests. Alternatives designating more area managed primarily for owl habitat will maintain more area for other old-growth related values.

The old-growth resources considered in Forest Plans totalled 5.4 million acres on the 17 National Forests included in this analysis. This represents 24 percent of the total acreage of these National Forests.

Acreage of old-growth ecosystems is an important consideration but so, too, are its distribution and continuity. As harvesting of the portion of old-growth forests suitable for timber production continues, in accordance with Forest Plan decisions, the resource becomes increasingly fragmented and subsequently may lose value for certain dependent wildlife species. This fragmentation and the length of time required to replace old-growth forests make decisions about the extent and continuity of stands to be retained vitally important.

A discussion of old-growth and late-successional forest wildlife species follows this section.

## **Current Situation and Trends by Region and Forest**

### **Oregon and Washington**

There has been much debate over the definition and estimates of the amount of old-growth forests; however, estimates from the Forest Plans and Plan-related inventories indicate there are about 6.3 million acres of old-growth forest on the 19 National Forests in Oregon and Washington. This 6.3 million acres represents about 31 percent of the total forested National Forest area in the Pacific Northwest, and about 25 percent of the total administered National Forest acres in the Pacific Northwest.

Of this total, about 4.7 million acres are found on National Forests within the range of the northern spotted owl; 3.0 million acres in Oregon, and 1.7 million acres in Washington. Approximately 2.1 million acres, or 44 percent of the inventoried old growth, are on lands scheduled for timber production (Table 3&4 – 27).

## California

Lands within National Forests in the Klamath Province in California contain approximately 650,000 acres of old-growth forests. Old growth occurs in the Douglas-fir forest type, favoring west-facing and north-facing slopes, but is also associated with the mixed-conifer type on east-facing and south-facing slopes, and to a lesser extent with the red fir forest type along ridgetops, and ponderosa pine on drier sites.

Approximately 194,000 acres of old-growth Forest occur on forest lands which are scheduled for timber production under Alternative A. This represents approximately 30 percent of the total old growth occurring within the Klamath Province. The remaining 70 percent (or 456,000 acres) occurs on lands which are not scheduled for timber harvest under current management direction (Table 3&4 – 27).

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 27 Estimates of Old-Growth Acres**

Estimated acres of old-growth forests on 17 National Forests included in this analysis.<sup>1</sup> (thousand acres)

National Forest	Total old-growth acres	Old-growth acres not suitable for timber production (and percent of total)	
		Current inventory	In Wilderness
		In Forest Plan allocations <sup>2</sup>	
Gifford Pinchot	198	11 ( 6%)	84 (42%)
Mt. Baker-Snoqualmie	644	232 (36%)	270 (42%)
Okanogan	316	172 (54%)	45 (14%)
Olympic	267	47 (18%)	118 (44%)
Wenatchee	319	149 (47%)	84 (26%)
Wash. Subtotal:	1,743	611 (35%)	602 (35%)
Deschutes	348	98 (28%)	123 (35%)
Mt. Hood	345	52 (15%)	171 (50%)
Rogue River	99	22 (22%)	37 (37%)
Siskiyou	348	88 (25%)	91 (26%)
Siuslaw	34	3 ( 9%)	20 (59%)
Umpqua	535	70 (13%)	149 (28%)
Willamette	595	101 (17%)	194 (33%)
Winema	712	84 (12%)	139 (20%)
Oregon Subtotal	3,015	519 (17%)	925 (31%)
Subtotal, Oregon & Wash.:	4,759	1,129 (24%)	1,526 (32%)
Klamath	211	55 (26%)	84 (40%)
Mendocino	94	28 (30%)	39 (41%)
Shasta-Trinity	209	51 (24%)	116 (56%)
Six Rivers	136	27 (20%)	56 (41%)
Calif. Subtotal:	650	161 (25%)	295 (45%)
Total:	5,409	1,289 (24%)	1,823 (34%)

<sup>1</sup> Rounded to nearest thousand acres; therefore, may not add to total shown.

<sup>2</sup> Includes old-growth forests on lands not technically suited for timber production.

Source: Forest Land and Resource Management Plans or Plan-related inventories.

## Environmental Consequences      Oregon and Washington

On each National Forest under current Forest Plans (Alternative A) some portion of the remaining old-growth forest is protected from timber harvest. However, on those areas considered by Forest Plans to be suited for timber production, the amount of old-growth forest present at any particular time depends on the rate of harvest of old-growth forest stands and the rate at which other, mature forests develop old-growth characteristics over time.

For the 13 National Forests within the range of the spotted owl in these two States there will be a 9 percent reduction in remaining old-growth forests by the end of the first decade under existing Forest Plans (Alternative A).

## California

It is estimated that old growth occurs on approximately 194,000 acres of lands suitable for timber harvest within the Klamath Province. Under Alternative A, an estimated 12.5 percent of that portion of old growth located on lands suitable for timber production is scheduled to be harvested each decade. Therefore, approximately 24,000 acres will be harvested in the first decade, representing about 4 percent of the total old-growth forest on National Forests in the Klamath Province.

If this same trend were to continue in each subsequent decade, a total of 121,000 acres, or 19 percent, of existing old-growth forest on National Forest lands in the Klamath Province would be harvested in the next 50 years. However, it is important to note that the Forest Plans for each of the National Forests in the Klamath Province in northern California are not finalized. Many additional resource protection measures are being adopted as these plans are being developed. As a consequence, the estimates developed in the preceding paragraph likely overestimate the harvest of old-growth forests which is likely to occur in the next 50 years.

Additionally, there are approximately 850,000 acres in the Klamath Province which are in a mature forest condition. Much of this land will not be harvested and will grow into an old-growth condition in coming decades. As a consequence, the old-growth resource is likely to increase on National Forests in the Klamath Province in the next five decades.

## The Affected Environment and Environmental Consequences

The following table displays the effects of each alternative on the currently existing old-growth forests in terms of the acreage which is withdrawn from timber production and that which is suitable for timber production. This area effect corresponds to the land suitability classification of the particular alternative. As the acres suitable for timber production decrease, the area which will be retained as old-growth forest increases (Table 3&4 – 28).

**Table 3&4 – 28 Old-Growth Acres Suitable for Timber Production**

Estimated old-growth acres suitable for timber production by State by alternative, for the 17 National Forests included in this analysis. (million acres\*)

Alternative	State	Old-growth acres suitable for timber prod.	Old-growth ac. not suitable for timber prod.	Total acres
Alt. A	WA	.53	1.21	1.74
	OR	1.57	1.44	3.02
	CA	.19	.46	.65
Alt. A Total		2.30	3.11	5.41
Alt. B	WA	.26	1.49	1.74
	OR	1.29	1.72	3.02
	CA	.11	.54	.65
Alt. B Total		1.66	3.75	5.41
Alt. C	WA	.25	1.49	1.74
	OR	1.20	1.82	3.02
	CA	.11	.54	.65
Alt. C Total		1.56	3.85	5.41
Alt. D	WA	.21	1.53	1.74
	OR	.94	2.07	3.02
	CA	0	.65	.65
Alt. D Total		1.16	4.25	5.41
Alt. E	WA	.49	1.25	1.74
	OR	1.51	1.51	3.02
	CA	.30	.35	.65
Alt E Total		2.30	3.11	5.41

\*Rounded to nearest 10,000 acres; therefore, may not add to total shown.

The 1.16 million acres of old-growth forest suitable for timber production in Alternative D is not nesting, roosting, and foraging habitat predominately because of elevation, species, or its location east of the range line.

The old-growth forest suitable for timber production, and other mature and overmature timber, constitute much of the current timber sale opportunities; therefore, it can be expected that the speed of old-growth forest conversion on that portion scheduled for timber harvest will occur in inverse proportion to the acreage available. The smaller the amount

of acreage left available for harvest, the faster it will be harvested. The 50-11-40 rule of Alternatives B through D and the 40-20'-40 rule of Alternative E, will mitigate conversion to a varying extent depending on the age and condition of adjacent, non-old-growth forest on a quarter township basis. The following table shows the estimated acres of old-growth forest that will remain after the first, second, and fifth decades. The estimates do not consider ingrowth, or stands that may acquire old-growth forest characteristics during the 50-year period (Table 3&4 – 29).

## The Affected Environment and Environmental Consequences

**Table 3&4 – 29 Estimate of Old-Growth Acres Remaining**  
 Estimate of old-growth acres remaining for the 17 National Forests included in this analysis (million acres\*)

Alternative	State	Current inventory	End of the first decade	End of the second decade	End of the fifth decade
Alt. A	WA	1.74	1.68	1.59	1.41
	OR	3.02	2.64	2.28	1.74
	CA	.65	.63	.60	.53
Alt. A Total		5.41	4.95	4.47	3.67
Alt. B	WA	1.74	1.72	1.68	1.60
	OR	3.02	2.71	2.40	1.96
	CA	.65	.64	.62	.58
Alt. B Total		5.41	5.06	4.70	4.14
Alt. C	WA	1.74	1.72	1.68	1.60
	OR	3.02	2.73	2.44	2.03
	CA	.65	.64	.63	.59
Alt. C Total		5.41	5.09	4.75	4.22
Alt. D	WA	1.74	1.72	1.69	1.63
	OR	3.02	2.78	2.55	2.24
	CA	.65	.65	.65	.65
Alt. D Total		5.41	5.16	4.89	4.51
Alt. E	WA	1.74	1.68	1.61	1.44
	OR	3.02	2.67	2.32	1.82
	CA	.65	.63	.62	.57
Alt. E Total		5.41	4.98	4.55	3.83

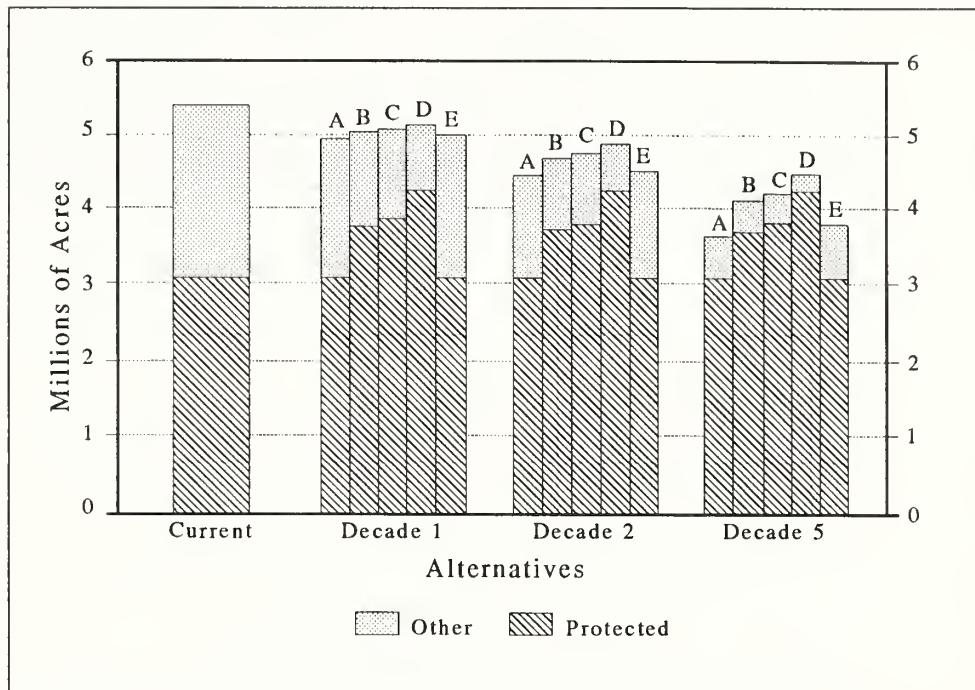
\*Rounded to nearest 10,000 acres; therefore, may not add to total shown.

Of the acres projected to remain in the fifth decade, about 1.29 million acres are in congressionally designated Wilderness, National Recreation Areas, or similarly protected areas; and 1.82 to 2.96 million acres, in Alternatives A, E, B, C, and D, respectively, are in other management areas with no timber harvest (including designated areas managed primarily for owl habitat), or are on lands not suitable for timber production because of regeneration difficulty or potential for irreversible resource damage.

The following figure displays the projected acres of old-growth forest remaining at the end of the first, second, and fifth decades of the planning period for each alternative (Figure 3&4 – 20).

**Figure 3&4 – 20 Old-Growth Forest Inventory**

Old-Growth forest inventory estimate, acres protected, and acres of existing old-growth remaining at the end of decade 1, 2, and 5, by alternative.



Timber harvest and road construction have the greatest environmental effects on the old-growth resource. Regeneration harvesting of old-growth stands produces a sudden change to the grass and forb successional stage. In addition, most of the harvested area will be harvested again before it can reach the age of current old-growth stands. Road construction can clear 5 acres of vegetation per mile of road built. The alternative with the greatest potential for harvesting old-growth forest, and thus affecting spotted owl habitat and other old-growth related resources, is Alternative A, followed by Alternatives E, B, C, and then D.

The size, shape, and arrangement of old-growth stands affect values of the stands for habitat for plants and animals. Harvest of old-growth forest (or loss of old-growth forest through fire or insects or disease) will separate the stands, reduce their size, and increase the amount of edge.

Habitat effectiveness for some plants and animals may be reduced if old-growth stands are harvested; for other species, habitat effectiveness may be increased as other successional stages are interspersed in large blocks of mature and old-growth stands. However, intensive harvest practices over large areas may generally be detrimental to most species, and habitat effectiveness may begin to decline faster than the reduction of old-growth acres might indicate. Alternative D (followed

### *The Affected Environment and Environmental Consequences*

by Alternatives C, B, E and A) would maintain the most acres of old-growth forest.

The alternative that would permit the greatest flexibility for vegetative management, that could be designed to increase habitat capability for species favoring early-successional forests such as deer and elk, would be Alternative A, followed by Alternatives E, B, C, and D. The actual effects of vegetative manipulation, and the extent of these effects, may not be fully known until project planning. Individual projects may be designed to minimize fragmentation, increase forage and/or edge effect, in any alternative.

## Wildlife Associated with Late-Successional Forests

### Wildlife

---

This section discusses wildlife, other than the northern spotted owl, associated with late-successional forests. Late-successional forests in this section refers basically to mature and old-growth forests at all elevations. The difference between late-successional forests and spotted owl nesting, roosting, and foraging habitat is that spotted owl habitat usually is defined as having an upper elevational limit. In addition to the northern spotted owl, over 100 species of amphibians, reptiles, birds, and mammals occur in late-successional forests (Brown, et al. 1985).

A summary of recent empirical studies (Ruggiero et al. 1991) listed 16 species that occur within the geographic range of the northern spotted owl that were closely associated with late-successional forests. Where these species are associated with late-successional forests, they occur almost exclusively or are significantly more abundant in late-successional forests than in other stand conditions (Ruggiero et al. 1991). Raphael conducted an extensive study which indicated that 11 additional species were strongly associated with late-successional forests in northwest California (Raphael 1985; Raphael 1988; Raphael et al. 1988; Raphael Pers. comm.). A species was designated as closely associated with a late-successional forest if it was found to be significantly more abundant (based on statistical tests) in that specific late-successional forest than in younger successional forests. These species are listed in Table 3&4 – 30.

Reviews of similar studies indicate a strong association with late-successional forest by the northern goshawk (*Accipiter gentilis*) on the Olympic Peninsula (Ruggiero Pers. comm.) and the bald eagle (*Haliaeetus leucocephalus*) throughout the range of the spotted owl (Johnson et al. 1991; Anthony and Isaacs 1989).

Over 60 percent of the 104 species of wildlife within the range of the northern spotted owl that were summarized (Ruggiero et al. 1991) are more abundant in late-successional forest habitat than younger forest habitat. Included are species known to require specific attributes of late-successional forests such as large diameter logs.

There are also species whose association with late-successional forests within the range of the northern spotted owl is not clearly understood or has not been studied. For example, based on research conducted outside the range of the northern spotted owl, harlequin ducks (*Histrionicus histrionicus*), which also occur within the spotted owl's range, may select streams within late-successional forests (Cassirer et al. 1991). Forest habitat associations of reptiles, fish, invertebrates,

## The Affected Environment and Environmental Consequences

and nonvascular plants have received little study and the habitat relationships of these groups are poorly understood.

**Table 3&4 – 30 Species Closely Associated with Late-Successional Forests<sup>1</sup>**

### Birds

Marbled murrelet <sup>2</sup> <i>Brachyramphus marmoratus</i>	Hairy woodpecker <i>Picoides villosus</i>
Vaux's swift <i>Chaetura vauxi</i>	Brown creeper <i>Certhia familiaris</i>
Bald eagle <sup>2</sup> <i>Haliaeetus leucocephalus</i>	Hermit warbler <i>Dendroica occidentalis</i>
Northern goshawk <i>Accipiter gentilis</i>	Winter wren <i>Troglodytes troglodytes</i>
Red-breasted sapsucker <i>Sphyrapicus ruber</i>	Golden-crowned kinglet <i>Regulus satrapa</i>
Chestnut-backed chickadee <i>Parus rufescens</i>	Varied thrush <i>Ixoreus naevius</i>
Western flycatcher <i>Empidonax difficilis</i>	

### Mammals

Big brown bat <i>Eptesicus fuscus</i>	Red tree vole <i>Arborimus longicaudus</i>
Fringed myotis <i>Myotis volans</i>	Pacific shrew <i>Sorex pacificus</i>
Silver-haired bat <i>Lasionycteris noctivagans</i>	Douglas' squirrel <i>Tamiasciurus douglasii</i>
Little brown myotis <i>Myotis lucifugus</i>	Western red-backed vole <i>Clethrionomys occidentalis</i>
Yuma myotis <i>Myotis yumanensis</i>	Fisher <i>Martes pennanti</i>
California myotis <i>Myotis californicus</i>	shrew-mole <i>Neurotrichus gibbsii</i>
Keen's myotis <i>Myotis keenii</i>	

### Amphibians

Northwestern salamander <i>Ambystoma gracile</i>	Tailed frog <i>Ascaphus truei</i>
Olympic salamander <i>Rhyacotriton olympicus</i>	Black salamander <i>Aneides flavipunctatus</i>
Del Norte salamander <i>Plethodon elongatus</i>	Roughskin newt <i>Taricha granulosa</i>

<sup>1</sup> A species was designated as closely associated with a successional forest if it was found to be significantly more abundant (based on statistical tests) in that successional forest compared to other successional forests. For this table, late-successional forest includes mature and old-growth stages. This information is based on studies by Ruggiero et al. 1991; Raphael Pers. comm.; Johnson et al. 1991; and Anthony and Isaacs 1989.

<sup>2</sup> See the section on threatened and endangered species for more discussion of marbled murrelets and bald eagles.

## Habitat Characteristics of Late-Successional Forests

The structural diversity and biological richness within late-successional forests provide unique habitat features required, preferred, or used by many wildlife species. The functional processes that occur within late-successional forests are not well understood. Some processes have been studied, such as those involving mychorrizal fungi and arboreal rodents, but most ecological relationships among species in mature and old-growth forests are virtually unknown.

**Snags.** Snags, which are standing dead or partially dead trees, are grouped into decay-classes that describe how long they have been declining. Decay-classes range from hard snags, which still have branches, to soft stumps that have lost all their bark. Primary excavators such as pileated woodpeckers (*Dryocopus pileatus*), northern flickers (*Colaptes auratus*), red-breasted sapsuckers (*Sphyrapicus ruber*), hairy woodpeckers (*Picoides villosus*), and white-breasted nuthatches (*Sitta carolinensis*) excavate cavities in snags.

Excavators select trees of various sizes, heights, and stages of decay. These cavities provide a habitat for a variety of secondary cavity users who cannot excavate their own cavities. For example, pileated woodpeckers, who excavate large cavities, require large snags typical of late-successional forests. They excavate new cavities each year and the old cavities become nest and roost sites for secondary cavity users such as the northern pygmy-owl (*Glaucidium gnoma*), northern flying squirrel (*Glaucomys sabrinus*), and several bat species (*Myotis* spp.) (Brown et al. 1985; Bull and Cooper 1991; Thomas et al. 1979).

**Large logs.** Large logs commonly found within late-successional forests provide cover as well as feeding, breeding, and resting habitat for wildlife. Species such as the deer mouse (*Peromyscus maniculatus*), western red-backed vole (*Clethrionomys occidentalis*), trowbridge shrew (*Sorex trowbridgii*), California slender salamander (*Batrachoseps attenuatus*), and ruffed grouse (*Bonasa umbellus*) prefer down-log habitat, and in some cases require it for breeding or cover. Suitable temperature and moisture levels created by the biomass of large logs provide micro-habitats for many small mammals and amphibians (Brown et al. 1985; Maser et al. 1984).

**Large trees.** Spaces under sloughing bark and natural cavities in large trees and snags provide habitat for 16 species of wildlife within the home range of the northern spotted owl, including bats and the brown creeper (*Certhia familiaris*). Bark sloughing occurs more slowly on large snags than on smaller snags (Brown et al. 1985; Maser et al. 1984).

In general, larger snags, logs, and trees provide higher quality habitat for a greater number of species for a longer period of time than smaller snags, logs, and trees.

**Multilayered canopies.** Various tree heights and ages create a multilayered canopy in late-successional forests. This multilayered

## *The Affected Environment and Environmental Consequences*

forest canopy provides a variety of perches, dispersal opportunities and travel routes for birds and arboreal mammals. Perch sites at various levels of the forest canopy are key habitat components for young birds. Before they have mastered flight, young birds use these perches to move through the forest canopy, avoid predators and find refuge from inclement weather. Some arboreal mammals, such as red tree voles (*Arborimus longicaudus*), move almost exclusively through the canopy and are reliant on a closed and layered canopy for food sources, feeding cover, predation cover, and dispersal or other movements (Carey et al. 1991).

### **Needs for Amounts of Late-Successional Habitat**

Home range and territory size for late-successional forest associated wildlife species determine the required size and spacing of suitable cover areas needed to ensure interaction among individuals in the population.

Needs for amounts of late-successional forests vary considerably among associated species. For instance, an ensatina salamander (*Ensatina escholtzii*) might restrict its movements to less than 100 feet and does not defend any portion of its home range (Stebbins 1954). The northern goshawk has a home range of about four to five thousand acres and is highly territorial, defending its entire home range (Reynolds 1979; Austin, pers. comm.). Whereas it might be possible to manage for ensatinas within one acre, an area of four to five thousand acres may be needed for a single goshawk.

Providing late-successional forest cover in amounts needed to meet species-specific requirements alone is not adequate. Quality of habitat must also be considered. As the amount of late-successional forest contained within the home range of a pair or individual decreases, survival is less likely. The point at which survival is compromised can be influenced by any number of elements including individual or species variation, particular habitat parameters, climate, or geographic location.

### **Habitat Pattern**

In general, the more late-successional forests that are protected, the higher the probability species reliant on such habitat will continue to persist in those locations. The patch size of habitat within a system of preserves also influences population survival. Probability of persistence is usually greater in larger patches of unfragmented late-successional forest than in smaller, unfragmented patches or any sized patches of highly fragmented late-successional forest (Rosenberg and Raphael 1986; Thomas et al. 1990; Lehmkuhl and Ruggiero 1991).

Distance between patches of late-successional forest determines if organisms can move freely between patches to ensure genetic exchange among reproductive individuals and continuance of genetic variation among individuals within the overall population.

How much habitat an individual organism needs, the amount of habitat needed to sustain a population, and the distance between habitat patches that an individual organism is able to travel, varies among species.

Smaller-bodied animals have smaller home ranges and achieve greater densities than do larger animals. As mentioned earlier, while many *ensatina* salamanders may inhabit one acre of habitat, the same acre would provide only a fraction of habitat needed by a single goshawk.

The dispersal capability of species varies with body size and habitat specificity. Such considerations led Lehmkuhl and Ruggiero (1991) to hypothesize that 47 out of 93 late-successional forest species they evaluated would benefit from decreased fragmentation of late-successional forests.

## **Environmental Consequences for Wildlife Associated with Late-Successional Forests**

Alternative A provides protection for the least amount of late-successional forest in the smallest contiguous patch size. Spacing of areas of late-successional forest is closer than in Alternatives B and E.

The relatively small size and relative isolation of the blocks in Alternative A limits their value in supporting late-successional forest-associated species over the long term, especially in the event of catastrophic occurrences such as extended drought or fire. These areas may provide for smaller species, but overall may not be large enough to support viable populations of an array of wildlife species associated with late-successional forest (Thomas et al. 1990; Lehmkuhl and Ruggiero 1991).

The Scientific Panel on Late Successional Forest Ecosystems rated Alternative A in this document as having a low or very-low probability of providing for wildlife species associated with late-successional forests (Johnson et al. 1991).

Alternatives E and B provide more late-successional forest in larger blocks spaced farther apart than Alternative A. In Alternatives E, B, C, and D, long-term protection of all acres within designated habitat areas will provide large blocks of contiguous late-successional forest as previously harvested areas develop late-successional forest characteristics.

Larger block size increases the likelihood that late-successional forest wildlife can occur within these blocks in numbers that will allow successful interaction as a population. Exchanges of reproductive individuals between blocks may be more difficult for smaller, less mobile species such as small mammals and amphibians (Lehmkuhl and Ruggiero 1991; Carey, in press).

## The Affected Environment and Environmental Consequences

The Scientific Panel on Late-Successional Forest Ecosystems rated Alternative B in this environmental impact statement as having a low to medium-low probability of providing for viable populations of late-successional forest associated wildlife species other than northern spotted owls.

Alternative E provides less late-successional forest in smaller blocks that are less well distributed throughout the range of the northern spotted owl than Alternative B. This alternative would have a lower probability of providing habitat needs for late-successional forest associated wildlife species within the Owl Management Zone than Alternative B. For areas outside of the Owl Management Zone, Alternative E provides less late-successional forest and a lower probability of providing habitat needs for associated wildlife species than Alternative A.

Alternative C provides more late-successional forest, larger blocks and closer spacing than Alternatives A, E and B. This alternative increases the likelihood of providing habitat needs for late-successional forest associated wildlife species and lowers the risk of negative effects as compared with Alternatives A, E and B.

Alternative D protects the most late-successional forest and, in general, has the highest probability among the five alternatives considered of meeting habitat needs for late-successional forest associated species, and the lowest risk of negative effects on populations of late-successional forest associates.

## Wildlife Species Associated with Early-Successional Forests

A variety of wildlife species within the range of the northern spotted owl use early-successional forests as primary habitat for breeding and/or feeding (Brown 1985: 50, Figure 12; USDA 1988b: III-45, Figure III-10).

Some of these species include the western bluebird (*Sialia mexicana*), orange-crowned warbler (*Vermivora celata*), song sparrow (*Melospiza melodia*), white-crowned sparrow (*Zonotrichia leucophrys*), American goldfinch (*Carduelis tristis*), western meadowlark (*Sturnella neglecta*), mountain beaver (*Aplodontia rufa*), and Townsend's vole (*Microtus townsendii*) (Brown 1985). Young forests, especially those in the open grass/forb/shrub stage, also provide foraging habitat for big game animals, such as the black-tailed deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus elaphus*). For these species, protection of older forests that provide spotted owls habitat provide security and thermal cover if stands have a 70 percent or greater canopy closure (Brown 1985: 238).

## Environmental Consequences for Wildlife Associated with Early-Successional Forests

Alternative A would provide the greatest amount of habitat in the youngest successional stages because of the higher level of timber harvest that would occur. Alternatives E, B and C would result in progressively less young forest habitat than Alternative A. Alternative D would provide the least amount of habitat in early-successional forests of all the alternatives.

Under each alternative, some existing late-successional forest under timber sale contract will be harvested, creating early-successional habitat. In addition, there is currently more early-successional forest intermixed in fragmented patterns with late-successional forest on National Forests across the range of the northern spotted owl due to timber harvest during the past 40 years than was historically present as a result of natural processes such as wildfire. Species using early-successional forests and edge habitats benefit more from alternatives that provide fewer and smaller designated areas managed primarily for spotted owl habitat.

## Forest Management Indicator Species

Many species inhabit a variety of forested and non-forested communities throughout the area included in this analysis. In order to evaluate the effects of management activities on species without listing them individually, the concept of management indicator species was developed. The management indicator species concept relies upon the habitat associations of a group of species being represented by one or more selected member of the group. These selected species are management indicator species and they represent their groups for the purpose of analysis and disclosure of project effects.

Management indicator species were selected for each Forest during Forest Planning efforts. Ongoing projects and programs are analyzed to assess impacts and disclose effects to all management indicator species (FSM 2634.1). It is not within the scope of this document to disclose the site-specific impacts of all programs and projects on management indicator species. The disclosure of site-specific impacts to management indicator species is part of Forest-level project planning and analysis.

This page left blank for notes

## Threatened and Endangered Species

---

### Introduction

This section contains information on Federally-listed threatened and endangered species other than the northern spotted owl, with some information on sensitive species. The U.S. Fish and Wildlife Service and National Marine Fisheries Service have the authority, through the Endangered Species Act of 1973, to list a species as either threatened or endangered based on its biological health. All agencies must comply with the Endangered Species Act regardless of the authority under which they operate. All plants and animals are eligible to be considered for listing.

The classification of endangered refers to those species in danger of becoming extinct throughout all or a significant portion of their range. Threatened species are those likely to become endangered in the foreseeable future (50 CFR 240). Species listed as threatened or endangered receive increased protection under the Endangered Species Act. Those species that are under consideration for listing are termed “proposed.”

The classification “sensitive” refers to species designated by Regional Foresters for which population viability is a concern. Sensitive species are not Federally designated under the Endangered Species Act and are not discussed in detail in this document.

All Forest Service planned, funded, authorized, permitted or executed programs or activities are reviewed for possible effects on species Federally classified as endangered, threatened, or proposed, as well as Forest Service designated sensitive species, and are evaluated on a site-specific basis during project planning. The findings are documented in a biological evaluation or biological assessment. This process provides a standard which ensures that all endangered, threatened, proposed, and sensitive species receive full consideration in the decision-making process. A list of endangered, threatened, proposed, and sensitive species, a discussion of Forest Service responsibilities under the Endangered Species Act, and biological evaluations can be found in most Forest Service offices (USDA Forest Service Manual 2670, USDA Forest Service, 1990a).

Occurrence and status of other Federally-listed threatened and endangered species on National Forests within the range of the northern spotted owl are displayed in Table 3&4 – 31. Proposed species are included.

**Table 3&4 – 31 Other Listed Threatened or Endangered Species**

Federally-listed threatened and endangered species, other than the northern spotted owl, including proposed species within the range of the northern spotted owl on National Forests included in this analysis.<sup>1</sup>

Status:	Occurrence <sup>2</sup>	Important Habitat Needs
<b>Endangered Species</b>		
<i>California Brown Pelican (Pelecanus occidentalis)</i>	Documented on Siuslaw National Forest	Beaches and offshore islands
<i>American Peregrine Falcon (Falco peregrinus anatum)</i>	Documented or suspected on all 17 National Forests except Okanogan	Cliffs/bluffs with suitable nesting ledges
<i>Northern Bald Eagle (CA) (Haliaeetus leucocephalus)</i>	Documented on all four National Forests in northern California	Nests in large old-growth trees near water
<i>Gray Wolf (Canis lupus)</i>	Documented on Gifford Pinchot, Mt. Baker-Snoqualmie, Wenatchee, and Okanogan National Forests; recurrent but unverified sightings on National Forests in Oregon Cascades and Rogue River areas.	Many habitat types used, prey base important
<i>MacDonald's Rockcress (Arabis macdonaldiana)</i>	Location uncertain, see text for discussion	Serpentine soils
<i>Klamath Short-Nosed Sucker (Chasmistes brevirostris)</i>	Documented on Winema, and suspected on Klamath National Forests	Aquatic
<i>Lost River Sucker (Deltistes luxatus)</i>	Documented on Winema National Forest	Aquatic
<i>Snake River Sockeye Salmon (Oncorhynchus nerka)</i>	Documented migrating through the Columbia River	Aquatic
<b>Threatened Species</b>		
<i>Northern Bald Eagle (OR, WA) (Haliaeetus leucocephalus)</i>	Documented on all 13 National Forests in Oregon and Washington	Nests in large old-growth trees near water
<i>Aleutian Canada Goose (Branta canadensis leucopareia)</i>	Documented on Siuslaw National Forest	Wintering habitat = wetlands, open areas, large bodies of water
<i>Grizzly Bear (Ursus arctos)</i>	Documented on Mt. Baker-Snoqualmie, Okanogan, and Wenatchee National Forests	Many habitat types used, food sources important
<i>Oregon Silverspot Butterfly (Speyeria zerene hippolyta)</i>	Documented on Siuslaw National Forest	Restricted to salt-spray meadows
<b>Proposed Species</b>		
<i>Marbled Murrelet (Brachyramphus marmoratus)</i>	Documented on Mt. Baker-Snoqualmie, Olympic, Siuslaw, Siskiyou, and Six Rivers National Forests; may occur on Klamath, Mendocino, Gifford Pinchot, Wenatchee, and Rogue River National Forests	Nests on moss and lichen-covered large lateral branches of old-growth trees, generally within 50 miles of salt water
<i>Snake River spring/summer chinook salmon (Oncorhynchus tshawytscha)</i>	Documented migrating through the Columbia River	Aquatic
<i>Snake River fall chinook salmon (Oncorhynchus tshawytscha)</i>	Documented migrating through the Columbia River	Aquatic

<sup>1</sup> For discussion on threatened, endangered, and sensitive fish species, see section on Water Quality and Fish Habitat.

<sup>2</sup> Includes all 17 National Forests in Washington, Oregon, and California included in this analysis.

Habitat requirements of the Aleutian Canada goose, California brown pelican, MacDonald's rockcress, and Oregon silverspot butterfly are distinct from those of the northern spotted owl; therefore, the alternatives considered in this document would have no effect on these species. Alternatives that require less roading may reduce potential human interactions and provide beneficial effects for American peregrine falcon, gray wolf, and grizzly bear. Spotted owl nesting, roosting, and foraging habitat may provide habitat for the northern bald eagle and marbled murrelet. Recovery plans are in effect for two species: peregrine falcon and bald eagle. Each endangered, threatened, or proposed species is discussed in detail below. Endangered fish species are discussed in the following section on Water Quality and Fish Habitat.

## Endangered Species

**Aleutian Canada Goose.** This species stops over in the Pacific Northwest during migrations between Alaska and wintering grounds in California. A small group of the birds winter in Oregon. Wintering habitat for Aleutian Canada geese includes wetlands, grasslands, or cultivated fields, usually near a large, undisturbed body of water (Bellrose 1980).

**California Brown Pelican.** Brown pelicans frequent beaches and offshore islands along the Pacific coast during late summer and early fall (National Geographic Society 1987; Farrand 1983). Occasionally, the brown pelican will rest in large, protected estuaries (Lowe, Pers. comm.). The species is quite tolerant of humans.

**American Peregrine Falcon.** Peregrines are limited to areas which contain suitable nesting ledges. Cliffs and bluffs typically found along river courses and other large bodies of water usually provide habitat for nesting peregrines (Call 1978). Falcons prefer to nest where the concentration of prey, generally smaller birds, is high and where habitat "structural characteristics...may increase prey vulnerability" (Skaggs et al. 1986).

Peregrine habitat on the Pacific coast is managed in accordance with the "Recovery Plan for American Peregrine Falcon" (USDI Fish and Wildlife Service, 1982) and standards and guidelines in the various Forest Plans. Peregrine falcon habitat occurs on the 17 National Forests included in this analysis.

**Gray Wolf.** Gray wolves utilize many habitat types. The availability of prey seems to be the primary factor in determining suitability of habitat. Primary foods for wolves are ungulate species, such as deer, but they also consume small mammals such as rodents. There have been reports of home ranges as large as 1,197 square miles (Paradiso and Nowak 1982).

## The Affected Environment and Environmental Consequences

**MacDonald's Rockcress.** This purple rockcress, a low-growing plant, inhabits serpentine soils. Its habitat is characterized by dry open woods and brushy slopes. This species is designated as an endangered species in California, where the only verified population of this plant is located in Mendocino County, but not on National Forests. A population of purple rockcress very similar to *A. macdonaldiana* has been documented near the California/Oregon border in the Smith River drainage of the Six Rivers and Siskiyou National Forests. A recovery plan for MacDonald's Rockcress has been completed (USDI Fish and Wildlife Service, 1990b). Although the recovery plan does not address the Six Rivers/Siskiyou population, a systematic study of the "purple arabis complex" is underway. The study is expected to reveal whether or not this "undetermined" population is actually *A. macdonaldiana* (Bartel pers. comm.). Until this study is completed, the plant will be treated as endangered in California, and in Oregon as a Federally classified Category 2 species, which is a species needing more information prior to listing.

**Northern Bald Eagle.** This eagle is listed as a threatened species in Oregon and Washington; endangered in California. Bald eagles can be found in habitat frequented by northern spotted owls. Eagles usually locate nests in the upper canopy of large old-growth trees, usually within two or three miles of coastal, lake, or river areas (Stalmaster et al. 1985). Night roosts are generally found in coniferous stands with well-developed canopies which provide thermal cover and shelter from wind and rain.

During winter months, bald eagles forage on water courses that support spawning salmon on some National Forests within the range of the northern spotted owl. The eagles generally perch in large deciduous and coniferous trees in close proximity to feeding areas. Eagles may gather at dusk, collecting in the open branches of large trees. From there they fly to communal night roosts, which are usually located within a few miles of feeding areas.

Although the number of nesting pairs per National Forest varies considerably, the bald eagle occurs on all 17 National Forests included in this analysis. Bald eagle habitat on the Pacific coast is protected and managed in accordance with "The Pacific Bald Eagle Recovery Plan" (USDI Fish and Wildlife Service, 1986), the "Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington" (Washington Department of Wildlife 1989), and standards and guidelines in the various Forest Plans.

## Threatened Species

**Grizzly Bear.** As omnivorous, opportunistic feeders, grizzly bears use a variety of habitats. Ninety percent of the grizzly bears' diet is vegetation. Areas used by bears in the spring contain early emergent vegetation. Examples of spring bear range include south-facing avalanche chutes and shrub fields. Big game winter range and

anadromous fisheries provide concentrated protein sources for bears in the spring and early summer. Summer and fall habitat components are generally composed of grass/forb and shrub communities. Examples of these include avalanche chutes, harvested units, sidehill parks, and open canopy forest. Winter den habitat is often above 6,000 feet in areas of heavy snowpack. Good denning sites may occur near ridges and upper avalanche chutes. Home ranges as large as 1,004 square miles have been reported (National Wildlife Federation 1987; Almack Pers. comm.).

**Oregon Silverspot Butterfly.** This species is restricted to the immediate coast areas of Oregon and Washington; its habitat is centered in salt-spray meadows. Originally, these meadows, or grass balds, were most likely caused by fire disturbance (McCorkle 1980).

**Species  
Proposed for  
Endangered or  
Threatened  
Status**

**Marbled Murrelet.** The marbled murrelet, a member of the alcid family, is a robin-sized seabird which congregates to feed primarily in salt water. Murrelets typically feed on small fish and invertebrates within one mile of shore (Marshall 1988). They are found throughout the North Pacific; the American subspecies range from Alaska to wintering grounds as far south as California. Within the area included in this analysis marbled murrelets are known to occupy habitats on the Olympic, Mt. Baker-Snoqualmie, Gifford Pinchot, Siuslaw, Siskiyou and Six Rivers National Forests.

Although marbled murrelets are numbered in the hundreds of thousands in Alaska (Marshall 1988), and up to 3,000 off the coast of Washington (Speich et al., in press), the numbers dwindle to approximately 1,000 breeding pairs off the coast of Oregon (Nelson et al., in press), and an estimated 1,650 birds in California (Carter and Erickson 1988).

Marbled murrelet nests have been found from southeastern Alaska to northern California in a range of forest structures from stands of wholly old-growth trees to mixed stands containing mature and old-growth trees.

Nest sites, characterized by depressions in moss and lichens, have been located on large, lateral branches. Murrelets have been detected as far inland as 43 miles in Washington, 35 miles in Oregon, and 24 miles in California (Nelson 1990; Hamer, Pres. comm.; Paton and Ralph 1988).

A review of the marbled murrelet led to an announcement by the U.S. Fish and Wildlife Service on June 20, 1991, of their intent to list the marbled murrelet as a threatened species in Washington, Oregon, and California. A final determination of listing status is due in June 1992. The focus of concern for the species is the loss of breeding habitat due to decreases in the mature and old-growth forest communities in the three States. Additional concerns for the marbled murrelet include loss of foraging habitat to both shoreline development and

## *The Affected Environment and Environmental Consequences*

degradation of marine waters, entanglement in gill nets of fishing fleets, and contamination of waters due to oil spills.

### **Environmental Consequences for Threatened, Endangered, and Proposed Species That May be Affected**

The proposed action includes standards and guidelines for management of spotted owl habitat on National Forests within the range of the northern spotted owl. Three Federally listed endangered or threatened species sensitive to human disturbance, American peregrine falcon, gray wolf and grizzly bear, may benefit from less activity or access to designated areas managed primarily for spotted owl habitat. Maintaining spotted owl nesting, roosting, and foraging habitat may also provide habitat for two of the Federally listed species within the range of the spotted owl: the northern bald eagle and the marbled murrelet. Providing habitat would have a beneficial effect for both species by increasing habitat protection.

**American Peregrine Falcon, Gray Wolf, and Grizzly Bear.** Alternatives that require less construction maintenance and use of roads would reduce the potential for interactions between humans and the three Federally listed threatened or endangered species which are sensitive to disturbance. Alternative D, which would require the fewest miles of roads for resource management, would provide the highest potential for reducing human disturbance. Alternatives B, and C provide increasing degrees of protection from human disturbances associated with roads than Alternative A which provides the least protection. Alternative E would provide more protection in Deferred and Research Areas than Alternative A, however this advantage is not well distributed throughout the area covered by this document.

**Northern Bald Eagle.** Protection and management requirements for occupied and unoccupied habitat for bald eagles are outlined in the “Pacific Bald Eagle Recovery Plan” and its associated document, “The Bald Eagle Implementation Plan.” The recovery of the northern bald eagle is addressed within the recovery plan and is independent of, and not reliant on, a northern spotted owl management strategy.

Bald eagles generally use late-successional forests at lower elevations. Alternatives A, B, C, and D in this document provide additional protection of unoccupied bald eagle habitat throughout the area covered by this document and are likely to afford increased protection of occupied sites beyond habitat guidelines identified within the Bald Eagle Recovery Plan. Alternative E provides additional protection of unoccupied bald eagle habitat in Deferred and Research areas within the Owl Management Zone, which are generally at higher elevations such as adjacent to the Cascade crest in Oregon and Washington and higher elevations along the Oregon Coast Range and Klamath Provinces. Alternative E provides less habitat protection than Alternative A for the Olympic Peninsula Province and portions of the Oregon Coast Range, Washington Cascades and Oregon Cascades Provinces outside of the Owl Management Zone, especially in lower elevation forests.

Assuming that protection of northern bald eagle habitat associated with late-successional forests increases throughout the area included in this analysis from Alternatives A through D, Alternative A provides the least additional bald eagle habitat protection than the Bald Eagle Recovery Plan and Alternatives B and C provide progressively more habitat protection. The most additional habitat protection would be provided for in Alternative D. Alternative E provides more habitat protection than Alternative A within the Owl Management Zone and less protection than Alternative A outside of the Owl Management Zone.

**Marbled Murrelets.** Survey work and information on marbled murrelets is new and limited, in part because they are relatively difficult to survey. Sporadic Forest Service efforts to survey for marbled murrelets on a range-wide basis in Washington, Oregon and California began around 1989. In 1991, survey efforts increased, especially in areas associated with timber sale planning (Gunderson, Pers. comm.).

Because the marbled murrelet is a Federally proposed species and has not been listed as threatened or endangered to date, there is no comprehensive protection plan or management direction afforded the murrelet through the Endangered Species Act. Conferencing with the U.S. Fish and Wildlife Service on projects that are likely to jeopardize a proposed species is required for all Forest Service activities that are proposed in potential marbled murrelet habitat.

Although this document is specific to the northern spotted owl, all alternatives considered may benefit the marbled murrelet by providing protection to at least a portion of occupied sites.

Table 3&4 – 32 below reflects known occupied sites on National Forests and does not reflect additional potential sites where surveys have not been completed.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 32 Occupied Marbled Murrelet Sites**

Occupied marbled murrelet sites<sup>1</sup> on National Forests within designated areas managed primarily for spotted owl habitat, reserved, and unavailable lands by alternative.

Alternatives					
	A	B	C	D	E
Number <sup>2</sup>	48	92	120	161	40
Percent	30	57	75	100	25

<sup>1</sup>A location with conclusive nesting evidence consisting of chicks, eggshells found on the ground, or discovery of a nest; or with circumstantial evidence of probable use or nesting including one or more of the following: birds observed, a) flying into or out of the canopy, b) landing in trees, c) calling from stationary locations, d) circling overhead repeatedly and regularly, and e) flying silently through the canopy. Sites with consistent high activity, evidenced by more than 25 detections per visit, are also considered occupied sites.

<sup>2</sup>Each alternative includes all known occupied sites, totaling 161 current to September 1991 in designated areas managed primarily for spotted owl habitat, reserved lands and other lands unsuitable for timber on the following National Forests: Olympic, Gifford Pinchot, Mt. Baker-Snoqualmie, Siuslaw, Siskiyou, and Six Rivers.

Alternatives B, C and D within this document provide additional protection of potential marbled murrelet habitat throughout the area included in this analysis and are likely to afford increased protection of occupied sites. Alternative E provides additional protection of potential marbled murrelet habitat in Deferred and Research MPAs within the Owl Management Zone. Fewer known marbled murrelet sites are protected under Alternative E on the Mt. Baker-Snoqualmie National Forest in the Owl Management Zone than under Alternative A. Alternative E provides less potential habitat and known murrelet site protection than Alternative A for the Olympic Peninsula and Oregon Coast Range provinces and on the Gifford Pinchot National Forest outside of the Owl Management Zone.

Based on protection of known marbled murrelet sites and potential habitat, Alternative E has a slightly higher probability than Alternative A to provide for marbled murrelets in the Owl Management Zone on the Siuslaw, Siskiyou and Six Rivers National Forests. Alternative A has a slightly higher probability than Alternative E to provide for marbled murrelets on the Mt. Baker-Snoqualmie National Forest in the Owl Management Zone and on the Olympic, Gifford Pinchot and Siuslaw National Forests outside of the Owl Management Zone.

Alternatives B, C, and D have higher probabilities than Alternative A and E to provide for marbled murrelets. Alternative C would have a slightly higher probability than Alternative B to provide for marbled murrelets, while Alternative D would have the highest probability of resulting in the greatest degree of protection for marbled murrelets.

The Scientific Panel on Late-Successional Forest Ecosystems indicated in their report that Alternative A would have a very-low to low

probability and Alternative B would have a low to medium-low probability of resulting in a viable population of marbled murrelets (Johnson et al. 1991). However, this environmental impact statement is intended to provide specific management direction for only northern spotted owls.

In all cases, assessment of effects on marbled murrelets is restricted by the lack of information on their presence within, and needs for, habitat. As future survey data becomes available, more reliable and specific management alternatives and assessments for the marbled murrelet might be necessary.

This page left blank for notes

# Water Quality and Fish Habitat

---

## Introduction

The interactions between climate, geology, human activity, and landforms directly affect watershed processes and water quality. The quality of fish habitat in a stream reflects processes and activities occurring throughout the watershed.

Forested areas are important groundwater recharge areas for aquifers. The aquifers regulate flows for streams and provide groundwater for domestic and municipal uses. Undisturbed forests typically provide cool, high quality water that is low in suspended sediments. Within the elevation range of northern spotted owl habitat, stream flows typically vary greatly during the course of the year. The frequency and magnitude of peak flows can be increased by land use activities. Intensive timber harvest may exacerbate the effects of rain-on-snow events, situations where rainfall on snowpack can cause runoff amounts greater than the rainfall would alone. Rain-on-snow events can result in higher peak flows which may cause damage to stream channels and associated fish habitat. These impacts are typically reduced in less intensely disturbed watersheds.

Large trees moderate water temperatures by shading streams. Once these trees fall into the stream, large woody debris creates habitat for fish and aquatic insects, provides nutrients, stabilizes and sorts bedload, and stabilizes the channel. Complex habitats found in streams are considered by researchers to be highly productive. Many streams no longer have complex habitats due to activities such as removal of woody debris, channelization for flood control or river travel, poor land use practices, and natural events such as large floods. The functions of large wood in streams, the history of wood removal from streams and the influence of forest and range land management throughout the Pacific Northwest are described by Maser et al. (1988) and Mehan (1991).

The National Forests in the range of the northern spotted owl contain a mosaic of watershed and fish habitat conditions. These range from pristine areas (i.e., Wilderness, unroaded areas, reserves, etc.) with high water quality and complex, productive fish habitat to highly impacted areas with poor water quality and poor habitat conditions.

## Salmonid Fishes

The salmonid fishes, notably the anadromous, or sea-going forms, are the most valuable to the region, both culturally and economically. Eight species of anadromous salmonids are found within the range of the northern spotted owl. These include pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), steelhead trout

## The Affected Environment and Environmental Consequences

(*O. mykiss*), cutthroat trout (*O. clarki*), and Dolly Varden (*Salvelinus malma*). National Forests provide spawning habitat for returning adults and rearing habitat for juveniles before they migrate to the ocean. This is less true for chum and pink salmon as they spawn in the lowermost reaches of streams near tidewater, and the juveniles spend little time rearing in freshwater.

Within the northern spotted owl's range, most precipitation occurs in the November through April period, and the increased volume of freshwater flowing into the ocean triggers spawning migrations for many stocks of anadromous fishes into rivers and streams.

Individual stocks of these species constitute unique gene pools for different river systems. A stock is defined as a group of interbreeding individuals which is largely reproductively isolated from other groups (Ricker 1972). There may be several different stocks within a species in an individual river system. Observing variations in life history characteristics, such as the timing of adult migrations, is one method to identify stocks. Examples include early and late run coho, spring, summer, fall, and winter chinook, and summer and winter steelhead.

Anadromous salmonids throughout the region support sport and/or commercial fisheries, Native American fisheries, and Native American cultural practices. The decline in populations of these fishes in many watersheds has led to serious concern among management agencies, user groups, the scientific community, and the general public. A committee of the American Fisheries Society, a professional society of fishery biologists and natural resource managers, recently identified 214 native, naturally-spawning stocks of anadromous fish at risk in California, Oregon, Idaho, and Washington (Nehlsen et al. 1991) and listed 106 extinct populations of west coast salmon and steelhead.

Fish populations are affected by many factors in addition to habitat such as interactions with other species, commercial fishing, sport fishing, dams, high seas interception, and weather. Isolating any one factor's effect on populations is difficult. However, for many of the stocks at risk, the highest quality remaining spawning and rearing habitat is in National Forests.

Indication of public and scientific concern about anadromous fishes in the region was the publishing in 1991 of proposed rules in the Federal Register by the National Marine Fisheries Service to list Snake River sockeye and chinook salmon under the Endangered Species Act. The National Marine Fisheries Service has since listed the Snake River sockeye as an endangered species. These salmon use the Columbia River as they migrate to and from spawning grounds in the Snake River system. Activities in compliance with Forest Plans on National Forests within the range of the spotted owl will have minimal impact on the Columbia River. The Forest Service has determined that the Snake River sockeye and chinook salmon will not be adversely affected

by any of the alternatives evaluated in this environmental impact statement. In a letter from the National Marine Fisheries Service dated January 7, 1992, the Service indicated that they concur with this determination. The alternatives contain standards and guidelines for spotted owl habitat management and are not plans for timber harvest or development activities beyond those in approved Forest Plans.

Resident salmonid species and non-game fishes are also found within the range of the northern spotted owl. Whether located within National Forest streams or downstream from them, they are also dependent on high quality water and habitat resulting from activities and conditions upstream and upslope. Two species of fish Federally listed as endangered are found on National Forests within lands considered in this document. They are the Klamath short-nosed sucker (*Chasmistes brevirostris*) and the Lost River sucker (*Deltistes luxatus*).

Water quality, riparian areas, and aquatic habitats are assumed to be protected by implementation of best management practices (USDA Forest Service, 1988a) and adherence to standards and guidelines published in Forest Plans. The purpose of best management practices is to achieve water quality standards (U.S. Environmental Protection Agency 1987) and comply with state water quality standards. The best management practices are used to meet the intent of the Clean Water Act of 1972, and as amended in 1977 and 1987. During environmental analysis for a project, mitigation measures are also identified to help protect water quality, riparian areas, and aquatic habitats in National Forest. Watershed and fish habitat projects are commonly implemented to restore and improve upslope and instream conditions for water quality and fish habitat. Additional restrictions/exclusions of activities are in place for municipal watersheds within National Forests throughout the region.

## Environmental Consequences for Water Quality and Fish Habitat

The effects of spotted owl management on watershed and fisheries values are indirect. The alternatives vary by designated areas managed primarily for spotted owl habitat and therefore, by the degree to which land disturbing activities may take place. The most common form of such activity on National Forests within the range of the northern spotted owl is timber harvesting and associated road building.

This document is not intended to provide management direction for fish. For further review of fish management policies, the reader should refer to the Regional Guides and Forest Plans.

While water quality, riparian areas, and aquatic habitats are assumed to be protected by implementation of best management practices, standards and guidelines, and mitigation measures, there is still an element of risk associated with timber harvesting and road building.

## *The Affected Environment and Environmental Consequences*

Episodic events such as large floods, rain-on-snow events, and other factors may result in poor water quality and damaged aquatic habitat. With less disturbance, risk would be reduced. Consequently, there would be less risk as the total designated area managed primarily for spotted owl habitat increases across alternatives. In general, the more acreage of riparian area that has old-growth forest characteristics, the less the effect of management activities on water quality.

Alternatives A, E, B, and C, in respective order, would afford greater degrees of protection for water quality and fish habitat. Alternative D, the alternative with the most designated area managed primarily for spotted owl habitat would afford the greatest protection for watershed and fisheries resources. Of the alternatives, this would have the least risk of erosion, reduced water quality, and potential degradation of aquatic habitat.

Alternatives B, C, D, and E include some currently logged areas within designated areas managed primarily for spotted owl habitat. In these areas, watershed conditions would gradually return to those found in undisturbed forests. Aquatic habitat would become gradually more complex, as large wood falls into stream channels. Stream channels may stabilize depending upon existing conditions. Where populations of anadromous salmonids are found, the potential for smolt production would increase as habitat conditions improve.

Alternatives A, E, B, and C, in respective order, would have greater land areas with these positive effects. Alternative D would have the greatest land area with these positive effects.

Habitat conditions for the Lost River sucker and the Klamath short-nose sucker would likely improve if Alternatives B, C, or D were implemented. Sediment input would decrease and water quality would improve within and downstream from the National Forests. These effects would be cumulative. Alternative E prescribes no special management for the Winema National Forest, where these fish have been documented. Thus, conditions would not be expected to improve due to this alternative.

Two management alternatives analyzed by the Scientific Panel on Late-Successional Forest Ecosystems were identical to Alternatives A and B. Their report indicated that Alternatives A and B would have a very-low to low probability of maintaining viable populations of sensitive fish stocks (Johnson, et al. 1991).

Alternatives B, C, and D utilize the standards and guidelines from the ISC Report (Thomas et al. 1990: Appendix Q) for management within designated areas managed primarily for spotted owl habitat. Removal of individual or small groups of trees for other resource management programs would be reviewed on a case-by-case basis.

This may have an effect on fish habitat restoration projects within designated areas managed primarily for spotted owl habitat which utilize large trees for instream structures. It is unclear to what extent this would affect such projects at this time. To minimize disturbance to spotted owls during the nesting and fledging period, the timing of fish habitat and watershed restoration projects during the year, as well as the types of equipment used, may also be affected under all alternatives.

## Soils

---

### Introduction

Forest soils are protected by management direction in the Regional Guides, and more specifically by management under the standards and guidelines of the Forest Plans (or Forest-specific direction where Forest Plans are still being prepared.) These standards and guidelines, their effectiveness, and the environmental consequences of management under them, are disclosed in the environmental impact statements accompanying the Forest Plans and other direction.

Designated areas managed primarily for spotted owl habitat and other new standards and guidelines will provide added measures of protection to soil resources. Designated areas managed primarily for spotted owl habitat will not be subject to the potential short-term effect of timber harvest. These short-term effects, usually lasting no more than 5 years, may include displacement and mixing of soil horizons, soil compaction, and increased turbidity and sedimentation in streams due to soil erosion. Retention of designated areas also allows natural nutrient recycling as the material from dead and down trees is allowed to decompose on site. Some of this effect can be negated by the occurrence of intense wildfires.

Alternatives E, B, C, and D all result in fewer development and ground disturbing activities than Alternative A. The effects on soils under Alternative A will be the same as those predicted in the Forest Plans; those of the other alternatives will be respectively less impactful. Alternative D, the alternative with the most designated area managed primarily for spotted owl habitat, would afford the greatest protection for soils.

## **Land Adjustment, Uses, and Permits**

---

### **Historic Trends and Current Situation**

Numerous activities and uses take place on National Forests. These include an active land exchange program, permits for access, transmission and water lines, and electronic sites among others. Hydroelectric facilities also use National Forest resources and sites under permits from the Forest Service, Federal Energy Regulatory Commission, and others.

### **Environmental Consequences**

Most existing permits and facilities are considered compatible with the standard and guidelines of all alternatives. New development and new land exchanges that affect areas managed primarily for owl habitat could be restricted and in some cases precluded. This effect will increase through Alternatives A, E, B, C, and D as increasing area is designated to be managed primarily for owl habitat.

Land adjustment, uses, and permits are discussed in more detail in Appendix H.

## Mineral and Energy Resources

---

### Affected Environment

Minerals are divided into three classes for management purposes: locatable, salable, and leasable minerals. The manner in which each is managed and the authority of the Forest Service to control the exploration for and development of each management class varies considerably.

#### Locatable Minerals

Locatable minerals are those metallic and nonmetallic minerals for which the 1872 Mining law gives United States citizens the statutory right to prospect for, locate, and develop claims on public domain lands. All valuable mineral deposits on lands open to mineral entry are locatable unless excluded because they are leasable or salable. Gold, silver, copper, and zinc are examples of minerals which are generally locatable.

Locatable minerals occur throughout the range of the northern spotted owl. There are about 26,000 mining claims in the Cascade, Klamath, Olympic and Coast Ranges of western Washington, western Oregon, and northern California. Of these, about 4,500 are within the designated area managed primarily as spotted owl habitat under Alternative B. The number of those claims would change proportionately to the acres dedicated under each alternative.

According to the U.S. Geological Survey (Diggles 1991), porphyry copper deposits are the largest and most well defined of the numerous types of mineral prospects, occurrences, and deposits known throughout the range. The U.S. Geological Survey reports seven known porphyry copper deposits in the Cascade geologic province, containing a total of 9.9 million metric tons. In addition, they estimate a 90 percent probability of an additional 8 deposits containing 8.0 million metric tons. Approximately 24 percent of the area where these types of deposits could occur are within the designated areas managed primarily for spotted owl habitat under Alternative C, and are assumed to be proportional to the areas designated by each alternative. Open pit mining is the primary method of extraction for porphyry copper.

## Salable Minerals

Salable minerals are common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. In general, these minerals are of widespread occurrence, of relatively low unit value, and are generally used for construction materials or for road building purposes. Disposal of salable minerals from public lands administered by the Forest Service is totally at the discretion of the Forest Service (see regulations at 36 CFR 228, Subpart C).

## Leasable Minerals and Energy Resources

Leasable minerals include those minerals that can be leased under one of the several mineral leasing acts (the Act of March 4, 1917, the 1920 Mineral Leasing Act, the 1947 Mineral Leasing Act for Acquired Lands, and the 1970 Geothermal Steam Act). In northern California, western Oregon, and western Washington, the leasable mineral commodities include oil and gas, geothermal energy, coal, and metallic minerals on acquired lands.

The entire Cascade Range of Washington and Oregon, as well as the eastern halves of the Klamath and Shasta-Trinity National Forests and 40 percent of the Mendocino National Forests in California, are prospectively valuable for geothermal resources. Geothermal exploration, to date, has been localized with little disturbance to each site. The location of drilling sites for exploration has been flexible; therefore, environmentally sensitive sites usually have been avoided.

All of the Siuslaw National Forest in Oregon, 40 percent of the Olympic National Forest, and 5 percent each of the Mt. Baker-Snoqualmie and Gifford Pinchot National Forests in Washington, are prospectively valuable for oil and gas resources. There are no prospective oil and gas resources within the four northern California National Forests.

Many National Forests within the range of the northern spotted owl have potential sites for small hydroelectric production. While the eventual development of these sites is possible, a slowing economic growth rate, and the success of energy conservation efforts have caused a decrease in energy consumption since the early 1970's. The future of low-head hydroelectric development on streams in the National Forests within the range of the spotted owl, and the subsequent effect of this development on spotted owl habitat, is not known.

Collection of firewood from National Forests has increased in popularity in the past 20 years. Between 1970 and 1979, some National Forests had an increase in requests for firewood permits as high as 1,000 percent. Most firewood is used for home heating. Regulation of woodburning stoves to preserve air quality may change trends in consumption.

## *The Affected Environment and Environmental Consequences*

Firewood is primarily taken from the woody residue left from timber harvesting and from trees that have died from insect infestations.

### **Environmental Consequences**

The effect of the alternatives on mineral and energy resources is directly related to the areas that would be withdrawn from mineral leasing or constraints placed on the development of those resources. Withdrawal of areas from leasing may not be necessary, since energy exploration and development activities impact very few acres. A more likely effect of designating areas managed primarily for spotted owl habitat would be mitigation measures attached to mineral leases and plans for locatable mineral development designed to protect spotted owl habitat. Environmental assessments would be prepared as necessary prior to the development of these resources.

#### **Locatable Minerals**

Based on historic practices, an estimated 40 percent of all mining claims have ongoing prospecting and exploration activities. Specific impacts to spotted owls and owl habitat would be assessed in the scope of individual proposals, through current procedures as required in the regulations (36 CFR 228).

Of all mineral prospects, 5 to 10 percent of the claims cover mineral prospects that are being seriously considered by industry and may result in 5 to 10 producing mines within the next 5 years. Some of these may be within designated areas managed primarily for owl habitat.

#### **Salable Minerals**

Salable mineral development typically takes the form of small sand and gravel pits, usually on the order of one acre in size. Because of the inherent low value of salable minerals, they are usually extracted where the rock is located at, or very close to, the surface of the ground and close to where they will be used. It would be unusual to need to develop such a source within an area managed primarily for spotted owl habitat. If such a case occurred, development would be minimal.

#### **Leasable Minerals and Energy Resources**

Leasable minerals are subject to exploration and development under leases, permits, or licenses which are issued by the Secretary of Interior upon receiving consent to lease from the Forest Service. The Forest Service makes decisions concerning the availability of lands for mineral leasing, based on whether development activities could be conducted in a manner which is compatible with land management objectives in a Forest's Land and Resource Management Plan.

Designation of northern spotted owl habitat requires much less energy than other forms of management on these same lands. Energy use on lands not dedicated for spotted owl habitat may increase if management intensifies on those lands. The main energy outlays during the planning period will be in monitoring habitat use. Monitoring levels will remain fairly constant across alternatives, due to present levels of scientific uncertainty regarding spotted owl biology. Energy use for monitoring will be considerably less than the same outputs required under intensive forest management.

Firewood availability will be proportionate to timber harvest. With lower timber harvest, there will be less residue available for firewood collection from road construction and timber harvesting activities. Firewood cutting is also prohibited within designated areas managed primarily for spotted owl habitat under the standards and guidelines for Alternatives B, C and D (Thomas et al. 1990: 325). Reductions in firewood availability may be partially offset by the decline in post-harvest slash burning due to air quality management restrictions.

## Recreation

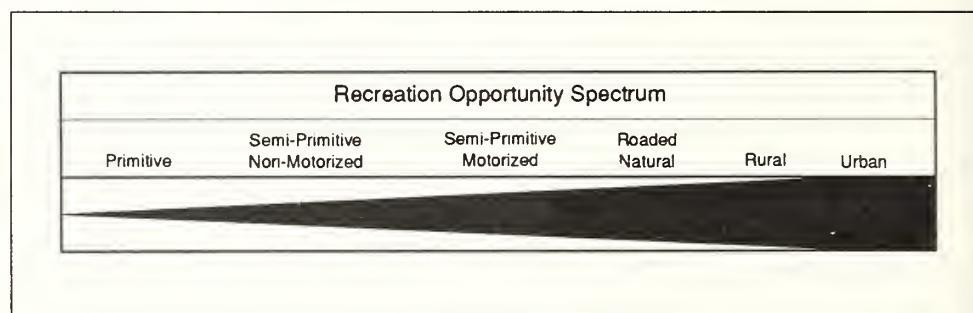
---

### Current Recreation

The National Forests within the range of the northern spotted owl provide significant opportunities for people to enjoy the outdoors. Whether their recreation is a day of downhill skiing, sightseeing along a highway, fishing, hunting, or finding solitude in a remote Wilderness, these lands provide a spectrum of settings, activities, and experiences. People choose a setting for their recreation experience.

The broad spectrum of recreation opportunities has been organized along a framework called the Recreation Opportunity Spectrum.

**Figure 3&4 – 21 Recreational Opportunity Spectrum**



The absence or presence of roads is one of the most critical aspects of a setting that affects people's recreation experience. The majority of developed sites such as ski areas, campgrounds, and visitor centers occur in the roaded setting classifications of Roaded Natural and Rural. Some urban developments also occur in these roaded settings.

In 1990, the Oregon and Washington National Forests with spotted owl habitat provided 14,900,000 recreation visitor days of use at developed recreation sites. (A recreation visitor day is equivalent to a 12-hour visit by forest recreationists.) The balance of recreation use in the roaded settings was dispersed along roads, streams, and rivers, and amounted to about 21,160,000 recreation visitor days.

Primitive and Semi-Primitive setting classifications are basically unroaded and provided about 3,840,000 recreation visitor days of use in 1990. The four northern California National Forests provided a total of 7,437,000 recreation visitor days distributed in similar portions along the Recreation Opportunity Spectrum.

In a recreation supply/demand picture, there is generally more than enough roaded settings to meet the demand. On many Forests, there

is a shortage of unroaded settings particularly in the Semi-Primitive Non-Motorized setting classifications.

## Environmental Consequences

Most recreation activities in unroaded settings disturb very little habitat and would not immediately or directly affect spotted owl habitat. The modification of habitat by building roads or developed recreation sites would negatively impact the spotted owl in its habitat. "Road construction diminishes the quality of habitat by creating edge and reduces the amount of habitat by the loss of forested land displaced by the road" (Thomas et al. 1991: 58). The same would be true if developed recreational sites were built in designated areas managed primarily for spotted owl habitat. Thus Alternatives A and E, as noted in discussions of other resource uses, would impact spotted owl habitat the most, Alternatives C and D the least.

Conversely, management to maintain or enhance spotted owl habitat in the National Forest will affect the type of setting and thus the recreational experience opportunity available to the public. Alternatives B, C, and D, with their reduced timber harvest, result in significantly less road construction.

The maintenance of the quality of habitat for the spotted owl, particularly in presently unroaded areas, will have the effect of maintaining the area suitable for Primitive or Semi-Primitive recreation classifications and not expanding the area for roaded recreation. Since there is generally a surplus of roaded recreation settings, these alternatives will not adversely affect those opportunities. Where the undeveloped settings are in short supply, these alternatives would maintain that opportunity for recreationists.

However, if funding for road maintenance (traditionally tied to timber management programs) declines, as would be expected under Alternatives B, C, and D, some existing roads would be closed for environmental protection and public safety. This would result in a reduction of the area available for roaded dispersed recreation. The roaded settings closed to motorized access, however, do not usually provide Semi-Primitive opportunities.

## The Affected Environment and Environmental Consequences

**Table 3&4 – 33 Winter Sports Areas**

Winter sports area construction or expansion potentially restricted.

Alternative	Winter Sports Area	National Forest
B,C,D	Mt. Hood Meadows Ski Area	Mt. Hood
C,D	Government Camp Winter Sports Area and Timberline Ski Area	Mt. Hood
C,D	Pelican Butte Ski Area	Winema
B,C,D	Lake of the Woods/Tri-lakes Ski Area	Winema/Rogue River
B,C,D	White Pass Ski Area	Wenatchee
B,C,D	Early Winters Resort	Okanogan
C,D	Crystal Mountain Ski Area	Mt. Baker-Snoqualmie
B,C,D	Hyak Ski Area	Mt. Baker-Snoqualmie
B,C,D	Ski Acres	Mt. Baker-Snoqualmie
B,C,D	Mt. Shasta Ski Area	Shasta-Trinity

source: Burget and Danzyck 1991

The standards and guidelines of Alternatives B, C and D are likely to restrict or stop the new construction or expansion of developed recreation sites in each alternative's designated areas managed primarily for spotted owl habitat. Most of the proposals for new or expanded ski areas within the spotted owl's range are in, or access to them is through, such areas. Though boundary adjustments are possible using the adjustment process, these ski areas may not be constructed or expanded in the near future under Alternatives C and D; Alternative B does not conflict with as many areas. See Table 3&4 – 33.

## Visual Resources

Scenery (or the visual resource) is among the resources provided by National Forests. Landscapes managed for visual resources include those kept in a natural state (managed for preservation), those managed to appear natural or slightly altered (managed for retention and partial retention), and those moderately to heavily altered by human activity (managed for modification and maximum modification). Since the early 1900's, visual resources in Oregon and Washington have been significantly influenced by the prevention of catastrophic wildfires. Since the mid-1950's, the main agents of change have been road construction and timber harvesting.

The appearance of the National Forests will correspond rather directly to the amount of timber harvested. The effect of Alternative A, and to a lesser extent Alternative E, will continue a process of modifying the forest landscape, though with changes designed to be as unobtrusive as practical. The alternatives which preserve the greater amount of spotted owl habitat will lead to a forest with fewer signs of modification by humans.

The forest is not static. Modification by growth, fire, age, storm, and pests will continue. With Alternatives B, C, and D, more of the changes will be naturally caused, and be in larger patches than if managed under Alternative A.

## Transportation System - Forest Roads

---

### Current Situation

National Forest road systems provide a variety of roads at diverse maintenance levels depending on the management objectives. Primary roads commonly meet several resource objectives, serving as main travel corridors through the forest or as main collectors of traffic from secondary roads. Secondary roads are generally shorter in length and provide access to locations for more specific uses such as timber harvest, fuels management, cultural treatments, firefighting, and access to recreational sites and opportunities.

Each National Forest maintains a road inventory which specifies which roads are necessary to meet both short-term and long-term resource objectives, and this inventory is updated annually. Roads which are no longer needed are identified for restoring to a natural state through such methods as planting trees and shrubs, mulching and seeding grasses, or roadbed obliteration. Roads which are not needed for ongoing or short-term projects can be proposed for closure in order to reduce conflicts with other resources or to reduce use and hence maintenance needs. Traffic use might conflict with spotted owl behavior. Opportunities exist through the road use permit process and timber sale contracts to control use periods or levels to mitigate conflicts with other resources. New roads remove trees during the construction phase, potentially affecting spotted owl habitat. These conflicts are identified and addressed through the NEPA and biological evaluation processes, providing maximum opportunities (e.g., road relocation, alternative harvest systems, or changes in design standards) to avoid adverse impacts.

### Environmental Consequences

Under Alternative A, harvest-related construction of secondary (local) roads will decrease in the first decade as compared to the previous 10-year average. This decrease is related to decreased harvest levels. Construction of primary (arterial and collector) roads increases slightly through the first decade to access undeveloped areas and then decreases as the road system is completed. During the next decade, the largest change in the road system will be an increase in the miles of closed roads due in large part to efforts to minimize impacts to wildlife. This change may amount to an estimated 7,000 miles of closed roads.

There will be proportionately less road building under alternatives with increased designated areas managed primarily for spotted owl habitat (Alternatives E, B, C, and D, respectively). There are likely to be increased road closures as timber sale-related road maintenance funds decrease. This will reduce public access and access for certain management activities such as Pacific yew collection and fire control.

### *The Affected Environment and Environmental Consequences*

It will also reduce road-related erosion and channeling and thus reduce stream sedimentation and turbidity, assuming road closure funding is adequate to close these roads.

# People and the Forests

---

## Overview

The range of the northern spotted owl encompasses western and central Washington and Oregon, and the northwest quadrant of California. The most important social and economic effects of the alternatives are experienced there.

**Population.** In 1990, that area was home to almost 7 million people. In Washington, 3,677,000 people (76 percent of the State's population) live in counties with spotted owls or spotted owl habitat (Huebner 1991). These counties include the Standard Metropolitan Statistical Areas (SMSAs) of Bellingham, Everett, Seattle, Tacoma, Yakima, and the Washington portion of the Portland metropolitan area. In Oregon, 2,636,000 people (93 percent of all Oregonians) live in counties in the spotted owl's range. This area includes all of Oregon's SMSAs—Portland, Salem, Eugene, and Medford. The spotted owl's range in northern California is in counties which have a total of 506,000 people (comprising less than 2 percent of all Californians). Redding is the SMSA.

**The Economy.** Over the last 50 years, this region has seen significant population growth and a considerable diversification in its economy, with a resulting reduction in its degree of dependence on timber and wood products. However, this diversification has happened primarily in metropolitan areas; rural areas within the range of the spotted owl remain heavily dependent on timber and wood products for their economic base.

**Employment and Wages.** Huebner's (1991) analysis showed that a small portion of each State's 1989 employment was in the lumber and wood products industry. Two percent of Washington's employment and 2.3 percent of its 1989 wages; 5.7 of Oregon's employment and 6.9 percent of its 1989 wages; and 0.3 percent of California's 1989 jobs and wages were in the lumber and wood products sector.

These State-wide percentages mask, however, the major dependence on this sector in many rural counties. Many of the rural counties in the spotted owl's range depend on the lumber and wood products industry for 15 percent of their jobs and 20 percent or more of their people's wages. Some are even more dependent. Skamania County, Washington, depended on timber for 29 percent of its jobs and 36 percent of its wages in 1989. Douglas County, Oregon, depended on timber for 25 percent of its jobs and 33 percent of its wages. The people in Trinity County, California, depended on timber for 16 percent of their jobs and 24 percent of their wages (Huebner 1991).

## *The Affected Environment and Environmental Consequences*

These figures also reflect the fact that lumber and wood products jobs pay better than the other jobs available in rural counties.

**Payments to Counties.** The people and communities in this area are further tied to the National Forests through the direct payments that are made to county governments annually. Twenty-five percent of the amount received for timber sales is paid to states for distribution among counties for roads and schools. It is a major portion of many counties' annual budgets; its reduction impacts all county services.

**Counties as Units of Analysis.** Despite the social and economic impacts to counties of changes in timber harvest levels, the employment or income effects of the alternatives have not been analyzed or displayed by county. There are two reasons for this: the effects of harvest changes cannot be accurately allocated to specific counties, and county information may mask significant effects.

All five of the alternatives result in a level of timber harvest reduced from that of the last 5 years. Those reductions will not be evenly distributed across the area.

Perhaps more importantly, they will not happen predictably across the area either. While harvest will be reduced from historic levels, there will continue to be timber harvesting and milling. Workers cross county lines to work in the woods and mills; logs are hauled to other counties for processing. As the value of logs increase, they are likely to be hauled longer distances. Thus, the analysis of social, employment, and income effects by county is unwarranted and the presentation of these effects by county would be misleading. However, because payments to counties are based on National Forest acreages, it is possible to project changes in payments to counties on a county specific basis.

Depending on unforeseeable factors such as which mills cut back or close and which remain open, and which logging firms stay in business and which close, individual counties could experience different futures.

The analysis and presentation of jobs and income effects in this environmental impact statement is by state. (Though workers and logs also cross state lines, the potential for misleading projections is much smaller than predictions for specific counties.) Readers can gain some insight into impacts in different parts of a state by looking at the changes predicted by National Forest.

Counties in the western United States are large and economically often highly variable. Impacts which could be devastating to isolated small communities may be invisible to the analysis if those communities are in a county that also has a large city and a healthier urban economy. Thus, this environmental impact statement presents information about estimates on social effects by a type of community, not by specific communities or counties.

## Timber Market Effects

---

### Introduction

This section describes the various economic impacts on timber markets resulting from implementation of the standards and guidelines included in the alternatives presented in this environmental impact statement. This discussion includes regional and national effects on product and timber markets. Alternative A will be used as the baseline from which all impacts and changes will be measured. The model used for the projections is the Timber Assessment Market Model (Adams and Haynes 1980; Haynes and Adams 1985). The model was updated to account for the current recession in the housing market, new information on log exports, and the current injunction on National Forest timber harvests in spotted owl nesting, roosting, and foraging habitat. See Appendix B for more information on the Timber Assessment Market Model.

The discussion of national market effects includes domestic production, imports, regional trade patterns, domestic consumption, and final product prices.

The discussion of regional market effects includes west coast regional stumpage prices, regional timber harvests and industry structure.

### National Market Effects

#### Domestic Wood Products Production

Total United States production of lumber has shown an overall increase since 1977. Between 1977 and 1990, the annual domestic production of lumber varied between 23 to 36 billion board feet, primarily due to fluctuations in housing and business cycles. The three West Coast States within the range of the spotted owl and the Southern States are the major lumber producing regions in the country. The South exceeded the Pacific Coast in terms of total production in the mid 1970's.

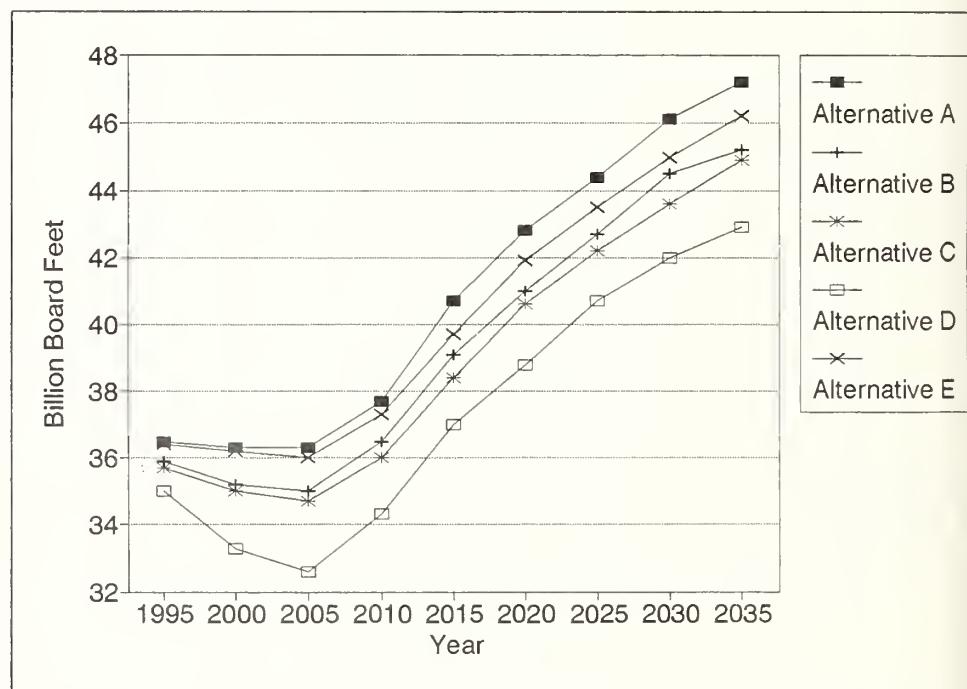
Changes in timber harvest levels from the 17 National Forests included in this analysis will have an impact on the total projected domestic production of lumber. The lumber supply reductions from Washington, Oregon, and northern California will only partially be offset by increases in production from other regions in the country. The projected domestic production of lumber, by alternative, is displayed in Figure 3&4 - 22. The figure shows lower domestic production of lumber for those alternatives with lower timber harvests. Domestic production declines slightly over the next decade in all alternatives due to a decline in the U.S. population entering the prime home buying age. (The "baby boomers" are passing prime home buying age in the 1990's. Demand for

## The Affected Environment and Environmental Consequences

housing should increase after the 1990's as their offspring start entering the prime home buying age.)

Alternative A will maintain fairly stable lumber production over the next 10 years. Alternatives B through D will progressively reduce national lumber production below this level. Alternative B will reduce annual national lumber production 3 percent from 36.3 to 35.2 billion board feet over the next 10 years. Alternatives C and D will reduce annual national lumber production 4 percent and 8 percent respectively over the next decade. Alternative E will reduce annual national lumber production less than 1 percent from 36.3 to 36.2 billion board feet over the next 10 years.

**Figure 3&4 – 22 Projected Domestic Lumber Production**  
Projected domestic lumber production in billions of board feet per year.



## Imports

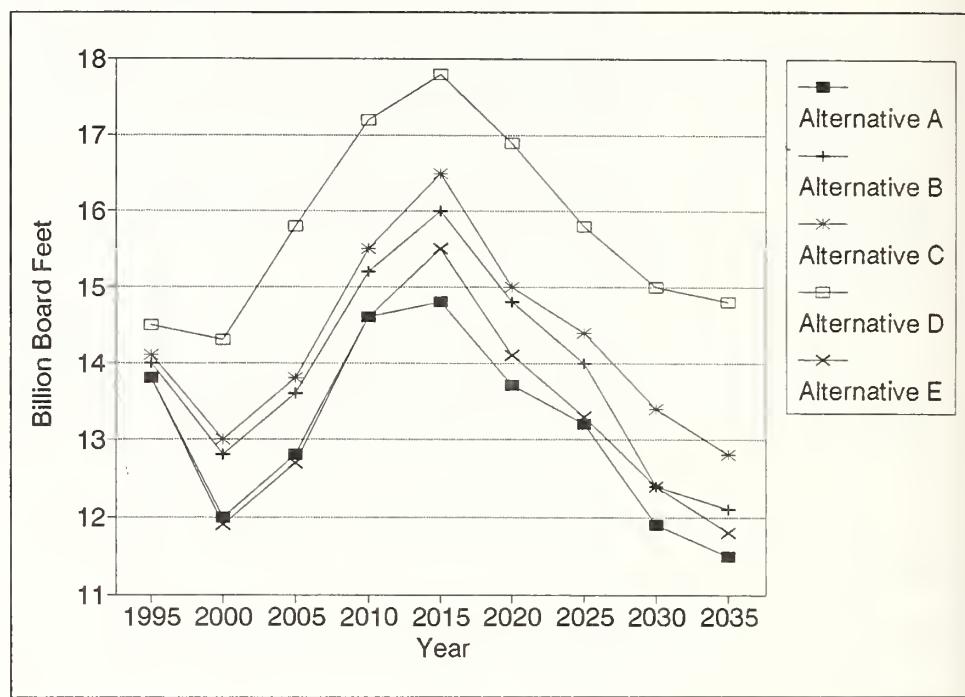
The United States has historically been a net importer of lumber. Imports have accounted for approximately 30 to 31 percent of the total United States lumber consumption. Between 1977 and 1990, lumber imports increased 33 percent, rising from 11.0 to 14.6 billion board feet annually. Virtually all of these imports have come from Canada. Internationally, countries or regions that may become larger suppliers of wood products in the future include the area recently known as the Soviet Union as well as tropical forests.

One likely effect of the implementation of alternatives which restrict domestic timber harvest is an increase in imports of softwood lumber from Canada. Although there has been debate about long-term timber supply prospects in Canada, there is little debate about its short-term supply capabilities. In addition, Canada sells some 3 billion board feet of softwood lumber to overseas markets, including Japan, Korea, and the Peoples Republic of China. Increases in prices in the United States would tend to draw Canadian lumber away from overseas markets.

The amount of lumber projected to be imported from Canada is shown in Figure 3&4 – 23. The alternatives which reduce domestic production of lumber show increased levels of imports from Canada in response to higher domestic prices. Imports from Canada decline slightly over the next decade in all alternatives due to a decline in the U.S. population entering the prime home buying age. (The “baby boomers” are passing prime home buying age in the 1990’s. Demand for housing should increase after the 1990’s as their offspring start entering the prime home buying age.)

In Alternative A, imports of Canadian lumber are expected to total about 12 billion board feet annually by the year 2000. Alternatives B, C, and D will all result in increases in the imports of Canadian lumber in response to increased prices in the United States. Alternatives B and C increase imports 7 percent and 8 percent, respectively, above Alternative A by the year 2000. The largest increase in Canadian imports occurs in Alternative D, with a 19 percent increase. Alternative E will not cause any substantial increases in the amount of lumber imported from Canada.

**Figure 3&4 – 23 Projected Lumber Imports from Canada**  
Projected lumber imports from Canada in billions of board feet per year.



### U.S. Consumption of Lumber, Plywood, and Oriented Strand Board

Total United States consumption of lumber, plywood, and oriented strand board has been increasing. From 1977 to 1990, United States consumption of lumber showed an overall increase of 8 percent, but fluctuated between 30 and 49 billion board feet due to changes in the housing and business cycles. During this same period, United States consumption of plywood and oriented strand board increased 24 percent overall, but fluctuated between 16 and 25 billion square feet.

Projected changes in timber harvest levels from the National Forests will only moderately affect national consumption of lumber. Increases in supplies, in response to higher prices from other regions of the country (primarily the South), and imports from foreign countries should offset most of the west coast reductions. These supply increases should avert any major changes in United States consumption of lumber, plywood, and oriented strand board. The difference in total consumption of these products between alternatives is expected to be relatively slight. Lumber consumption will range from 45 billion board feet annually in Alternative A, to 44 billion board feet annually in Alternative D, only a 2 percent difference. Plywood and oriented strand board consumption will range from 25.5 billion square feet annually in Alternative A, to 25.2 billion square feet annually in Alternative D, only a one percent difference. Alternatives B, C, and E will all fall within this range.

## Final Product Prices

National prices for softwood lumber and plywood peaked in the late 1970's. After that time, there was a sharp decline in lumber and plywood markets. The market hit a low in 1982 and then began to improve in the late 1980's. Recently, prices have again declined slightly to their present level.

Changes in timber harvest levels from the National Forests resulting from implementation of the alternatives would only moderately affect national prices for softwood lumber and plywood. National and international competition in final product markets should be sufficient to prevent large increases in national prices for manufactured wood products.

Compared to Alternative A, lumber prices would increase 2 percent in Alternative B, 3 percent in Alternative C, 9 percent in Alternative D, and 2 percent in Alternative E by the year 2000. Increases in plywood prices would be slightly higher, with increases of 3 percent in Alternative B, 6 percent in Alternative C, 9 percent in Alternative D, and 2 percent in Alternative E.

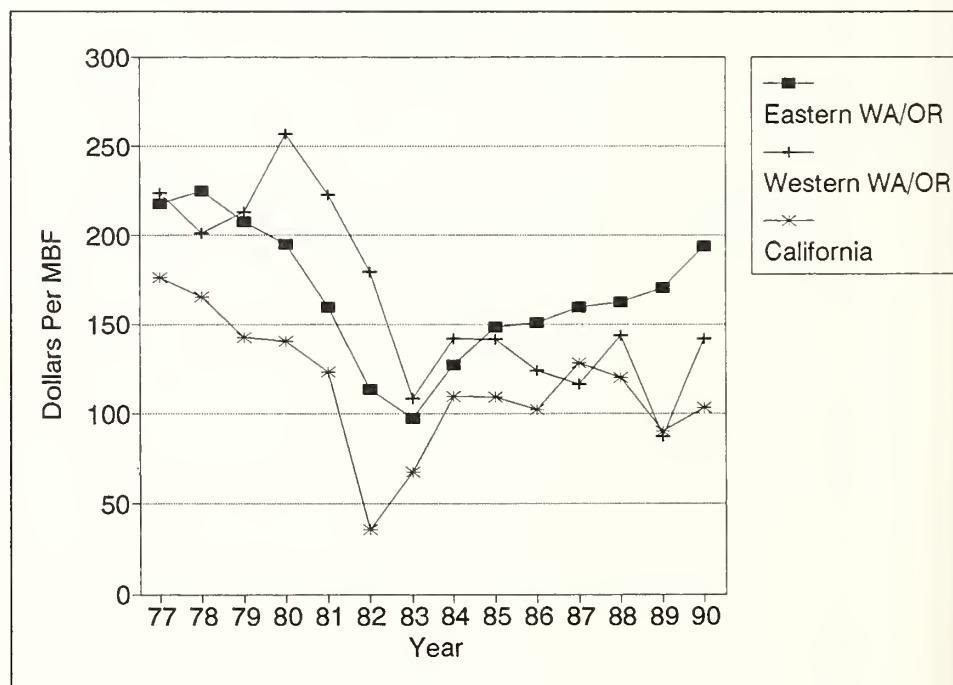
Increases in lumber and plywood prices will affect the total cost of new home construction. The cost of wood products comprises between 3 and 7 percent of the total cost of a house. Finished wood product prices will increase at the most 9 percent in any alternative. For a \$100,000 home, this amounts to an additional \$270 to \$630 to the total price. Increases of this magnitude are not anticipated to significantly impact the number of people who can afford to buy a house.

## Regional Market Effects

### Timber Stumpage Prices

Historic regional stumpage prices are shown in Figure 3&4 – 24. Stumpage price is the dollar amount paid for the right to harvest timber. Timber stumpage prices peaked in the late 1970's. After that time, there was a sharp decline in timber markets and prices. The market bottomed out in 1982 and 1983. Following that low point, timber prices have rebounded to their present level as market conditions improved. For the three States included in this analysis, the market has been divided into three areas for analysis purposes: west side Oregon and Washington, east side Oregon and Washington, and California. Historically, prices in California have been lower than those in Oregon and Washington. Within Oregon and Washington, since the mid-1980's stumpage prices have been higher on the west side than on the east side.

**Figure 3&4 – 24 Historic Stumpage Prices by Economic Region**  
Historic Stumpage Prices by economic region (1990 dollars per thousand board feet)

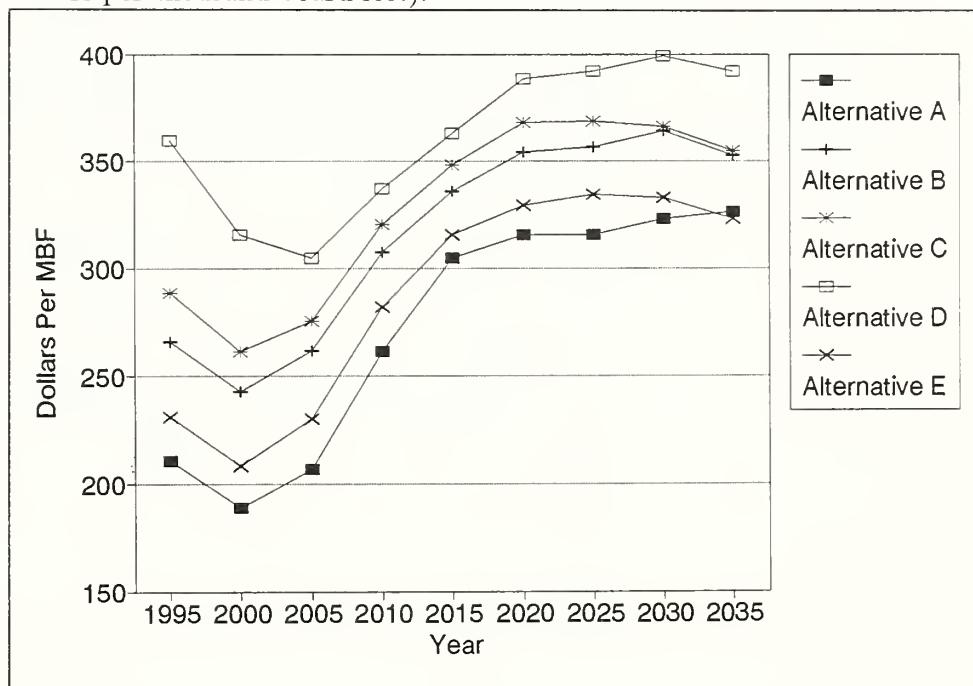


Reductions in timber harvest levels from the National Forests will increase timber stumpage prices in Washington, Oregon, and California. The projected timber stumpage prices are displayed in Figures 3&4 – 25, 26, and 27 for each of the three primary economic regions in Washington, Oregon, and California. The figures show higher stumpage prices for those alternatives with lower timber harvests. Stumpage prices decline slightly over the next decade in all alternatives due to a decline in the U.S. population entering the prime home buying age. (The “baby boomers” are passing prime home buying age in the 1990’s. Demand for housing should increase after the 1990’s as their offspring start entering the prime home buying age.) It is important, when comparing the alternatives, to place more emphasis on the relative differences between the alternatives than on the actual projections themselves.

Alternative A will have the lowest projected timber stumpage prices. Due to reductions in harvests, Alternatives E, B, C, and D will have progressively higher timber stumpage prices.

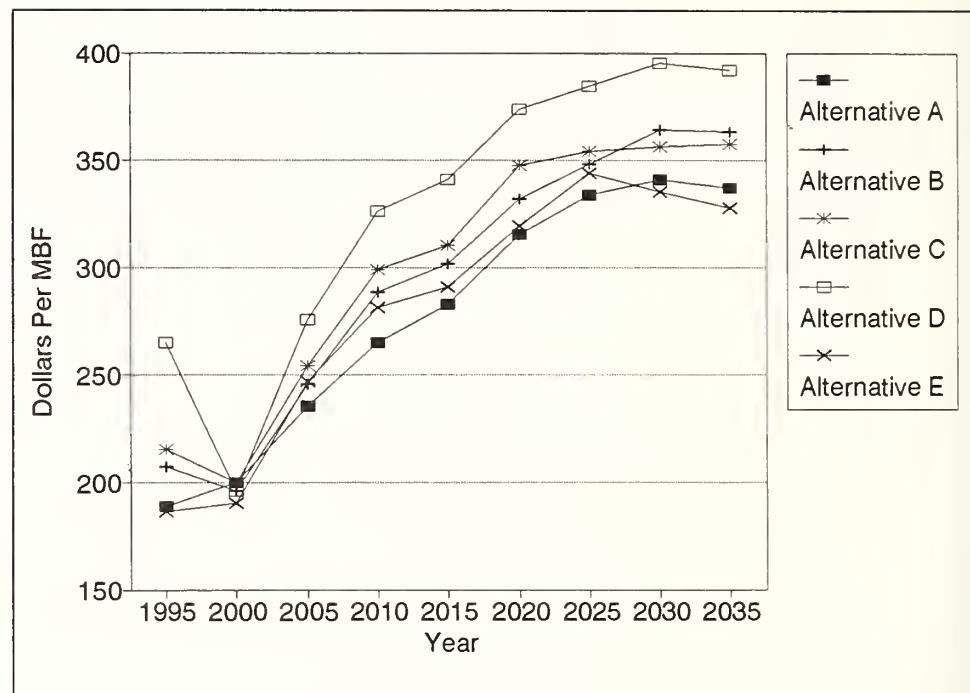
**Figure 3&4 – 25 Projected Stumpage Prices - West Side**

Projected stumpage prices for Washington and west side Oregon (1990 dollars per thousand board feet).



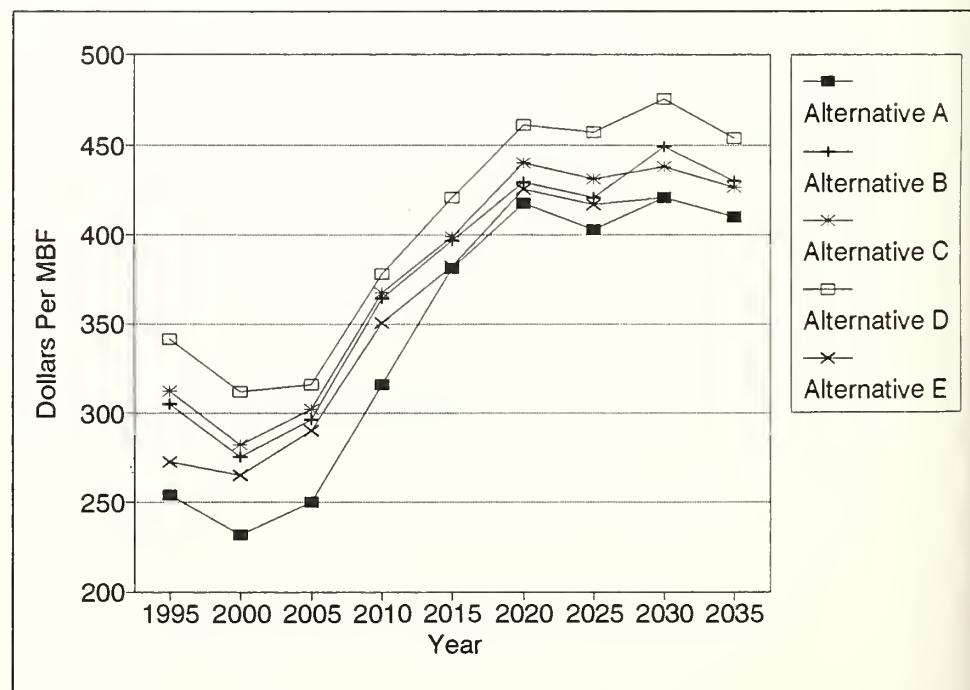
**Figure 3&4 – 26 Projected Stumpage Prices - East Side**

Projected stumpage prices for Washington and east side Oregon (1990 dollars per thousand board feet).



**Figure 3&4 – 27 Projected Stumpage Prices - California**

Projected stumpage prices for California (1990 dollars per thousand board feet).

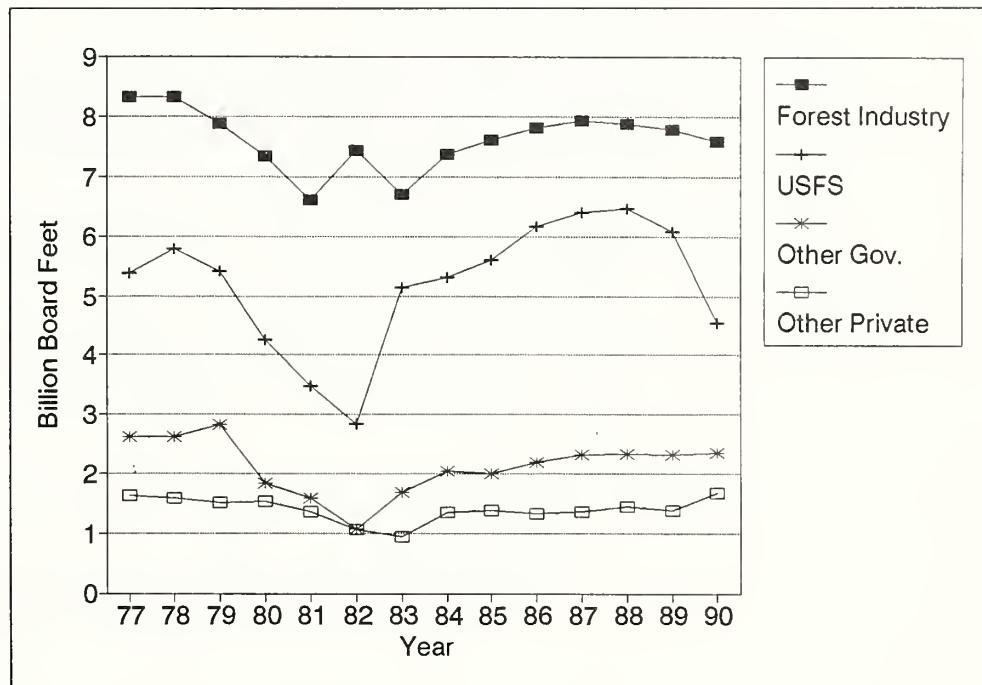


## Regional Timber Harvests and Industry Structure

On the Pacific coast, timber harvest levels over the last 3 years have been at all-time highs. Figure 3&4 – 28 shows softwood sawtimber harvest for National Forests and other lands. Harvests from the forest industry lands have been the largest component of total timber harvests. The next largest component has been from the National Forests. The smallest amount of harvest has been from non-industrial private timber land.

During the last decade there has been a consolidation trend in the industry, characterized by a reduction in the total number of mills and industry firms. In addition, logs are being hauled longer distances to be processed.

**Figure 3&4 – 28 Historic Timber Harvest by Ownership**  
Historic timber harvest by ownership in billions of board feet per year.

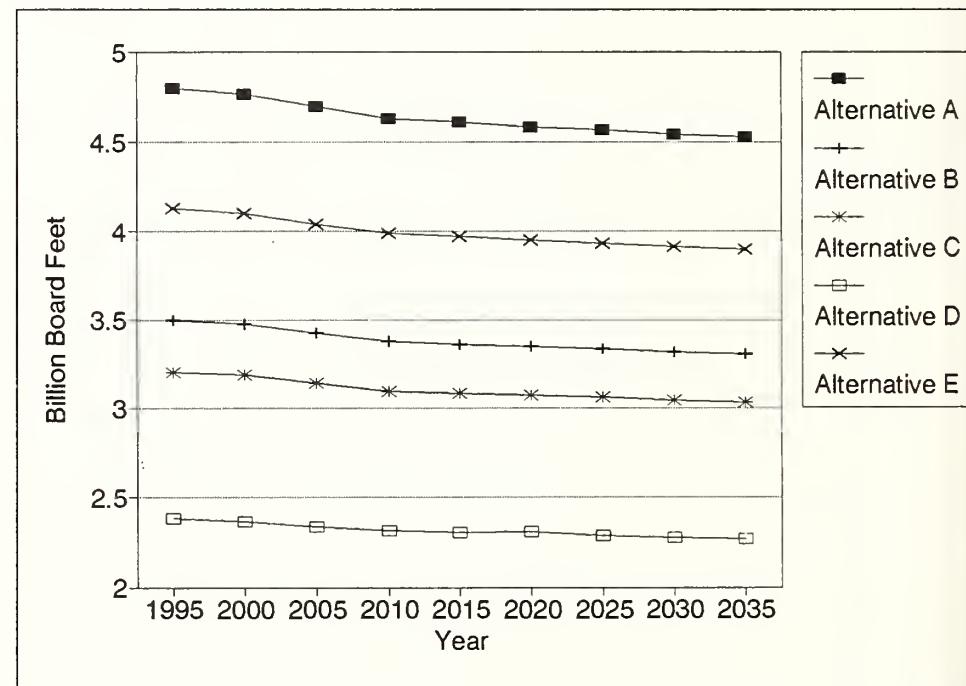


## *The Affected Environment and Environmental Consequences*

National Forest timber harvests will be affected by standards and guidelines proposed in this environmental impact statement. Alternative A will provide a harvest level of 4.8 billion board feet from all National Forests in Washington, Oregon, and California in the year 1995. Alternative B will reduce these harvest levels 27 percent to 3.5 billion board feet in that same year. Alternatives C and D will reduce these harvest levels 33 percent and 50 percent, respectively, by the year 1995 from the anticipated harvest level under the Alternative A. Alternative E will reduce harvest levels 0.7 billion board feet or 15 percent below Alternative A. The projected harvests from National Forests are shown in Figure 3&4 – 29.

**Figure 3&4 – 29 Projected Timber Harvests from National Forests**

Projected timber harvests from National Forests in Washington, Oregon, and California, in billions of board feet per year.

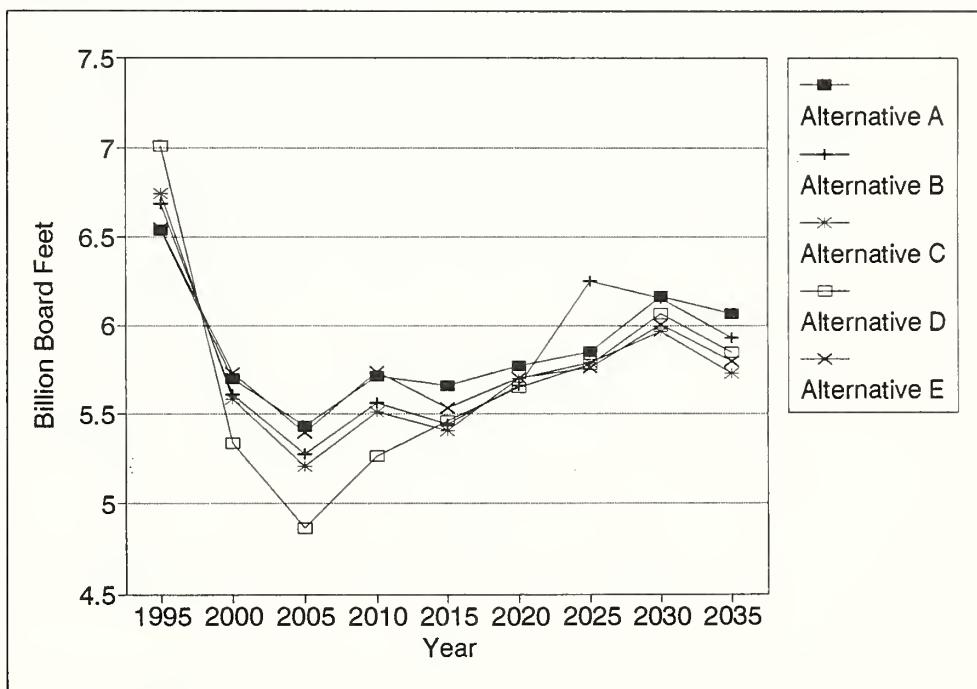


Harvests from the forest industry lands will also be impacted by the decline in harvest from the National Forests associated with Alternatives B, C, D, and E. The decline in harvest from National Forests will lead to an increase in stumpage prices. These higher stumpage prices will lead to higher harvests in the short term from forest industry lands. However, these private landowners will have lower harvests in the long term as a consequence of reduced inventories.

Other private lands will respond to the higher prices in a similar fashion. However, due to lower historic harvest rates in relation to inventory, they will be able to sustain these increased harvests over a longer period. These effects are displayed in Figures 3&4 – 30 and 31.

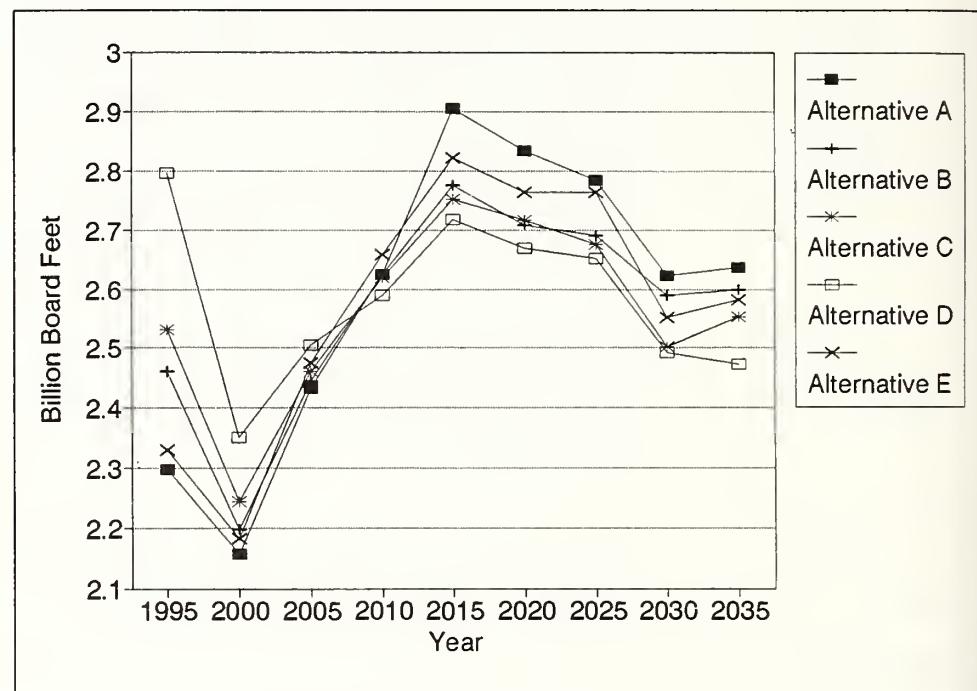
The historic trend toward industry consolidation including fewer mills, fewer firms, and longer hauling distances is projected to continue. This trend will be accelerated in those alternatives with lower National Forest harvest levels.

**Figure 3&4 – 30 Projected Forest Industry Timber Harvests**  
Projected forest industry harvests in Washington, Oregon, and California, in billions of board feet per year.



*The Affected Environment and Environmental Consequences*

**Figure 3&4 – 31 Projected Other Private Timber Harvests**  
Projected other private harvests in Washington, Oregon, and California, in billions of board feet per year.



## Employment and Income

---

### Affected Environment

Timber related employment is affected by technology and other factors that change over time. The employment multipliers used in this section represent past gains in efficiency. However, no attempt was made to project further gains in efficiency into the future. The emphasis is on change in employment and income resulting from changes in future timber supply from the National Forests. Potential future gains in efficiency would apply to any level of timber supply. This information was developed using historical relationships. The IMPLAN input-output economic modeling system was the primary tool used in the analysis. See Appendix B for further information on IMPLAN.

The employment and income estimates displayed in this section include the total effect throughout the economy associated with timber harvesting and processing. This total includes three separate components: direct effects, indirect effects, and induced effects. These components are defined as follows:

- *Direct Effects for Employment and Income* - Those that impact sectors either exporting processed wood products from the economic area or selling those products to final consumers. An example of direct employment would be people working in a sawmill. Direct employment accounts for approximately 10 of the 15 jobs per million board feet harvested. This equates to 67 percent of the total employment effect.
- *Indirect Effects for Employment and Income* - Those that impact other production, trade, and service sectors that provide the production inputs needed to manufacture the processed wood products. An example of indirect employment would be people who manufacture the saw blades used in the sawmills. Indirect employment accounts for approximately 3.5 of the 15 jobs per million board feet harvested. This equates to 23 percent of the total employment effect.
- *Induced Effects for Employment and Income* - Those that impact consumer spending within the economic area associated with jobs that support the direct and indirect production. An example of induced employment would be grocery store employees who sell products to the people working in sawmills or making saw blades. Induced employment accounts for approximately 1.5 of the 15 jobs per million board feet harvested. This equates to 10 percent of the total employment effect.

## *The Affected Environment and Environmental Consequences*

The past harvest levels from the 17 National Forests included in this analysis are shown in Table 3&4 – 34. The table displays the actual volume harvested from each Forest over the last 10 years. It also displays the average harvest volume between 1981 and 1990 plus the average volume harvest during the last 5 years. These figures are designed to provide an historic reference for use in evaluating the alternatives.

**Overall.** The total historic employment associated with these timber harvests from National Forests is estimated in Table 3&4 – 35 and Figure 3&4 – 32. These figures represent the total employment including direct, indirect, and induced effects. The income figures displayed in this analysis represent total personal income.

Total employment generated by National Forest timber harvest has averaged 62,400 jobs per year over the previous 10 years and 71,080 jobs during the last 5 years. The high point during that period was reached in 1988 when total employment rose to 80,100 jobs. Since 1988, employment has declined to the 5-year low of 52,100 jobs in 1990.

Historic income levels followed the employment generated by National Forest timber harvests. The income levels for each of the 17 National Forests included in this analysis are shown in Table 3&4 – 36 and summarized by state in Figure 3&4 – 33.

Total income generated by National Forest timber harvest has averaged \$2.8 billion per year over the previous 10 years and \$3.2 billion during the last 5 years. The high point during that time was reached in 1988 when total income rose to \$3.6 billion. Since 1988, income has declined to the 5-year low of \$2.3 billion in 1990.

**Washington.** In the State of Washington, employment generated by the harvesting and processing of National Forest timber has created an average of 17,900 jobs per year, producing income of \$806 million per year over the last 10 years. During the last 5 years, employment has averaged 18,200 jobs with an income of \$864 million.

**Oregon.** Of the National Forests included in this analysis, those in Oregon have the largest amount of employment and income generated by timber harvesting. In Oregon, employment created by the harvesting and processing of National Forest timber has averaged 37,000 jobs per year, with an associated average income of \$1.7 billion per year over the last 10 years. During the last 5 years, employment has averaged 43,300 jobs with an income of \$2 billion.

**California.** Employment generated by timber harvesting and processing in northern California paralleled Oregon and Washington over the last 10 years. In northern California, employment induced by harvesting and processing of National Forest timber averaged 8,400 jobs, with an income of \$300.7 million per year over the last 10 years. During

the last 5 years, employment averaged 9,600 jobs with an associated income of \$347.5 million.

## Environmental Consequences

Timber-generated employment is assumed to change at the same rate as harvest levels. The projections for future employment generated by timber harvests from the 17 National Forests included in this analysis are displayed in Table 3&4 – 37 and summarized for the three states in Figure 3&4 – 34.

All alternatives are anticipated to experience a decline in employment levels from the average over the last 5 years. However, when compared to 1990, the change may not be as great.

The projections for future income associated with the employment generated by timber harvests from the 17 National Forests included in this analysis are displayed in Table 3&4 – 38 and summarized for the three states in Figure 3&4 – 35.

Comparisons of projected employment and income levels associated with each alternative are made to the average levels over the last 5 years, as well as to Alternative A. A comparison to the average employment and income levels over the last 10 years is not made in the following narrative, since these employment levels are not as prominent in the memory of the people directly impacted as is the last year, or the last 5 years.

### Alternative A

Alternative A forms a point of comparison from which the effects of the remaining four alternatives are measured.

**Overall.** Alternative A indicates that a decline should occur over the next 10 years from recent annual employment and income levels. This is due to several factors, including the fact that the late 1980's was a period of very strong timber markets. Thus, harvest levels and corresponding annual employment and income were high at the end of the last decade. Despite a decline from past harvest levels, Alternative A will still potentially support the largest number of jobs per year associated with National Forest timber harvesting.

**Washington.** For the State of Washington, National Forest timber harvesting under Alternative A could support 11,800 annual jobs with an income of \$559.6 million. This represents a 5 percent reduction from 1990 in employment or 600 jobs, with an income of \$36.6 million.

However, the reduction is larger if compared to the average over the last 5 years. If compared to the 5-year average, Alternative A shows a 35 percent reduction or 6,400 jobs per year, with income of \$304.4 million.

## *The Affected Environment and Environmental Consequences*

**Oregon.** In Oregon, National Forest timber harvesting under Alternative A could support 28,200 jobs and an income of \$1.3 billion per year. This would be a 12 percent reduction in employment from 1990, or 3,800 jobs, with an income of \$159.4 million.

As with Washington, this is a larger reduction if compared to the past 5-year average. The reduction in annual employment is 15,100 jobs or 35 percent from the average employment level of the last 5 years.

**California.** In Alternative A, the four National Forests in northern California could support 8,000 jobs per year, with an income of \$286.5 million. This represents a 4 percent increase in employment and a 3 percent increase in income from 1990 levels. However, this would be a 17 percent reduction in employment, or 1,600 annual jobs with an income of \$61 million, from the average over the last 5 years.

## **Alternative B**

**Overall.** The total annual employment associated with National Forest timber harvests in Alternative B is projected to be 27,300 jobs with an associated income of \$1.22 billion. This is a reduction from Alternative A of 20,700 jobs or 43 percent, and a corresponding reduction in income of \$926 million.

If compared to the average annual employment levels over the last 5 years, this alternative could reduce employment by 43,800 jobs or 62 percent, and income by \$1.98 billion.

**Washington.** For the State of Washington, National Forest timber harvesting under Alternative B could annually generate about 5,000 jobs, with an associated income of \$237 million. This represents a potential reduction from Alternative A of 6,800 jobs or 58 percent, and a corresponding income reduction of \$322.5 million.

However, when compared to the actual average employment over the last 5 years, this would be a larger reduction amounting to 13,200 jobs per year or 73 percent, and an annual income reduction amounting to \$626.8 million.

**Oregon.** In Oregon, Alternative B could generate 18,600 jobs and create \$854 million in income related to National Forest timber harvests per year. This would be a reduction of 34 percent, or 9,600 annual jobs and \$449 million in income from Alternative A.

As with Washington, this would be a larger reduction if compared to the past 5 year average annual employment and income. Alternative B would have a 57 percent reduction in employment and income below the average of the last 5 years, or 24,700 jobs with an income of \$1.1 billion.

**California.** Timber harvest from the four National Forests in northern California could support 3,700 jobs, and \$133.8 million in income per year under Alternative B. This represents an annual reduction of 4,300 jobs and \$152.7 million from Alternative A.

However, if compared to historic levels, this would be an annual reduction of 5,900 jobs and \$213.7 million in income, or 61 percent from the average over the last 5 years.

### Alternative C

**Overall.** The total annual employment associated with National Forest timber harvests in Alternative C is projected to be 22,900 jobs, with an associated income of \$1.0 billion. This is a potential reduction from Alternative A of 25,100 jobs (52 percent) and a corresponding \$1.1 billion in income.

However, if compared to the average annual employment and income levels over the last 5 years, this alternative could reduce employment and income by 68 percent, or 48,200 jobs and \$2.2 billion in income.

**Washington.** For the State of Washington, National Forest timber harvesting under Alternative C could support about 4,200 jobs, with an income of \$201.1 million per year. This represents a reduction from Alternative A of 7,600 jobs or 64 percent, with a corresponding reduction in income of \$358.5 million.

However, the reduction from the average annual employment and income of the last 5 years is potentially larger. The change from average historic levels would amount to 14,000 jobs, or 77 percent with a loss in income of \$662.8 million.

**Oregon.** In Oregon, Alternative C could annually support 15,200 jobs and \$692.8 million in income associated with National Forest timber harvests. This would be a 46 percent reduction, or 13,000 jobs and income of \$611.1 million from the employment and income levels associated with Alternative A.

As with Washington, the reduction is larger if compared to the average over the past 5 years. Alternative C could reduce annual employment from the recent historic average by 65 percent, or 28,100 jobs with corresponding income of \$1.3 billion.

**California.** Timber harvests from the four National Forests in northern California could support 3,500 annual jobs with an associated income of \$126.2 million under Alternative C. This represents a 56 percent reduction, or 4,500 jobs and \$160.3 million in income from Alternative A.

## *The Affected Environment and Environmental Consequences*

However, if compared to the average annual employment over the last 5 years, this could be a reduction of 64 percent, or 6,100 jobs and \$221.3 million in income.

### **Alternative D**

Of the alternatives considered, Alternative D will have the lowest employment and income level.

**Overall.** The total annual employment associated with National Forest timber harvests in Alternative D is projected to be 12,400 jobs, with associated income of \$543.4 million. This is a 74 percent reduction from Alternative A, or 35,600 jobs and \$1.6 billion in income.

If compared to the average annual employment levels over the last 5 years, this alternative would possibly reduce employment and income by 83 percent, or 58,700 jobs and \$2.7 billion in income.

**Washington.** In the State of Washington, National Forest timber harvesting under Alternative D could support about 2,300 annual jobs and generate an income of \$107.1 million. This represents a potential reduction from Alternative A of 9,500 jobs or 81 percent, and \$452.5 million.

However, the annual reduction from the average over the last 5 years is potentially larger, amounting to 15,900 jobs or 87 percent, and \$756.9 million or 88 percent.

**Oregon.** In Oregon, Alternative D could annually support 7,600 jobs and \$347 million of income with National Forest timber harvests. This would be an employment reduction of 20,600 jobs or 73 percent, and \$956 million or 73 percent in income from Alternative A.

As with Washington, there could be a larger reduction if compared to the past 5 year average employment and income. Alternative D could reduce annual employment and income by 82 percent or 35,700 jobs and \$1.6 billion in income from the average over the last 5 years.

**California.** Timber harvests for the four National Forests in northern California could support 2,500 annual jobs with an associated income of \$89.3 million under Alternative D. This represents a 69 percent reduction, or 5,500 jobs and \$197.2 million in income from Alternative A.

When compared to the average over the last 5 years, this could be an annual reduction of 7,100 jobs and \$258.2 million in income or 74 percent.

## Alternative E

**Overall.** The total annual employment associated with National Forest timber harvests in Alternative E is projected to be 37,100 with an associated income of \$1.7 billion. This is a reduction from Alternative A of 10,900 jobs or 23 percent, and reduction in income of \$427.9 million or 23 percent.

If compared to the average annual employment levels over the last 5 years, this alternative could reduce employment by 34,000 jobs or 48 percent, and income by \$2.1 billion.

**Washington.** For the State of Washington, National Forest timber harvesting under Alternative E could annually generate about 8,800 jobs, with an associated income of \$416.5 million. This represents a potential reduction from Alternative A of 3,000 jobs or 25 percent, and an income reduction of \$143.1 million or 26 percent.

However, when compared to the actual average employment over the last 5 years, this would be a larger reduction amounting to 9,400 jobs per year or 52 percent, and annual income reduction amounting to \$447.5 million or 52 percent.

**Oregon.** In Oregon, Alternative E could generate 22,400 jobs and create \$1.0 billion in income related to National Forest timber harvests per year. This would be a reduction of 34 percent, or 5,800 annual jobs and \$280.6 million in income from Alternative A.

As with Washington, this would be a larger reduction if compared to the past 5 years average annual employment and income. Alternative E would have a 48 percent reduction in employment and income below the average over the last 5 years, or 20,900 jobs with an income of \$1.0 billion.

**California.** Timber harvest from the four National Forests in northern California could support 5,900 jobs, and \$212.3 million in income per year under Alternative E. This represents an annual reduction of 2,100 jobs, and \$74.2 million from Alternative A.

However, if compared to historic levels, this would be an annual reduction of 3,700 jobs and \$135.2 million in income, or 39 percent from the average over the last 5 years.

## Social Cost of Unemployment

Unemployment has an additional social cost to state and local governments. Increased unemployment can lead to increased demand for public funds. Additional funds may be needed for social workers, additional work force for local law enforcement, jails, mental health departments and substance abuse departments.

### *The Affected Environment and Environmental Consequences*

Impacts on public funds associated with increased unemployment will be magnified by an associated reduction in income tax revenue. Increased unemployment will reduce the amount of income available to generate tax revenue. The change in tax revenue is proportional to the changes in income displayed in this chapter.

Unemployment may also lead to reduced property values in some communities, and hence tax revenue. Reductions in revenue are expected where declines in timber-related employment and income are greater than increases in other sectors of the economy. The exact magnitude of this amount is difficult to determine due to the multitude of varying factors.

The potential risks of incurring these additional social costs of unemployment is directly related to the employment changes previously discussed in this section.

Table 3&amp;4 – 34 Historic Timber Harvest Levels

Historic timber harvest levels in millions of board feet per year.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	10-Year Average	Last 5-yr avg.
Olympic	227.7	163.1	244.3	310.4	242.7	244.8	243.4	264.3	194.4	116.7	225.2	212.7
Mt. Baker-Snoqualmie	211.8	124.5	216.3	235.6	210.9	259.0	296.0	248.1	188.7	135.7	212.7	225.5
Gifford Pinchot	263.1	244.1	368.9	356.8	381.2	346.5	417.8	514.2	444.3	313.4	365.0	407.2
Okanogan	81.3	18.8	78.5	54.6	62.4	68.4	111.3	133.5	116.8	51.9	77.8	96.4
Wenatchee	172.2	101.0	145.6	213.6	226.6	226.6	221.3	186.6	197.1	172.9	182.2	200.9
Washington Subtotal:	956.1	651.5	1053.6	1142.5	1110.8	1145.3	1289.8	1346.7	1141.3	790.6	1062.8	1142.7
Siuslaw	247.5	112.0	273.0	341.4	307.1	317.2	364.0	424.0	317.0	175.6	287.9	319.6
Mt. Hood	277.9	176.8	358.2	386.8	400.6	413.1	406.3	397.4	308.6	230.4	335.6	351.2
Willamette	470.7	386.7	555.0	609.7	775.3	758.4	899.5	928.3	858.9	535.4	677.8	796.1
Umpqua	197.1	135.5	267.1	326.3	313.3	402.9	551.9	412.3	555.7	429.3	359.1	470.4
Deschutes	193.7	145.9	212.3	244.1	291.3	222.1	205.6	166.4	218.3	199.1	209.9	202.3
Winema	77.2	46.7	124.6	189.6	163.4	213.8	255.0	262.1	259.0	215.5	180.7	241.1
Rogue River	179.5	79.1	178.5	152.3	217.1	180.8	203.5	229.0	233.4	134.3	178.8	196.2
Siskiyou	91.7	39.4	102.7	133.9	131.7	175.5	252.2	215.8	242.4	120.3	150.6	201.2
Oregon Subtotal:	1735.3	1122.1	2071.4	2384.1	2599.8	2683.8	3138.0	3035.3	2993.3	2039.9	2380.3	2778.1
Shasta-Trinity	177.0	97.0	262.0	220.0	242.0	230.9	227.9	295.7	192.5	243.0	218.8	238.0
Klamath	168.0	89.0	123.0	190.0	153.0	222.9	238.1	248.6	299.2	214.3	194.6	244.6
Mendocino	72.0	38.0	70.0	106.0	89.0	83.2	81.9	134.8	109.7	57.4	84.2	93.4
Six Rivers	114.0	58.0	127.0	136.0	153.0	136.1	177.3	200.1	195.1	89.3	138.6	159.6
California Subtotal:	531.0	282.0	582.0	652.0	637.0	673.1	725.2	879.2	796.5	604.0	636.2	735.6
Total All Forests:	3222.4	2055.6	3707.0	4178.6	4347.6	4502.2	5153.0	5261.2	4931.1	3434.5	4079.3	4556.4

## The Affected Environment and Environmental Consequences

**Table 3&4 – 35 Historic Employment Levels**

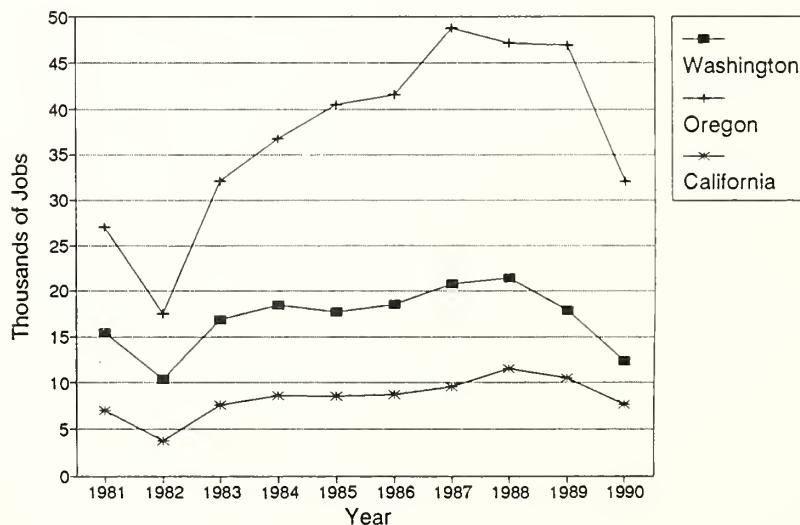
Historic employment levels generated by National Forest timber harvests (jobs per year).

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	10-Year Avg	Last 5-yr avg
Olympic	3600	2600	3900	4900	3800	3900	3900	4200	3100	1800	3600	3400
Mt. Baker-Snoqualmie	4100	2400	4200	4500	4100	5000	5700	4800	3600	2600	4100	4300
Gifford Pinchot	3800	3500	5300	5200	5500	5000	6100	7500	6400	4500	5300	5900
Okanogan	1100	300	1100	800	900	1000	1500	1900	1600	700	1100	1300
Wenatchee	2800	1600	2300	3000	3400	3600	3600	3000	3200	2800	2900	3200
Washington Subtotal:	15400	10400	16800	18400	17700	18500	20800	21400	17900	12400	17000	18100
Siuslaw	3300	1500	3700	4600	4200	4300	4900	5700	4300	2400	3900	4300
Mt. Hood	3800	2400	4900	5200	5400	5600	5500	5400	4200	3100	4600	4800
Willamette	7900	6500	9300	10300	13000	12800	15100	15600	14500	9000	11400	13400
Umpqua	2800	1900	3800	4600	4400	5700	7800	5900	7900	6100	5100	6700
Deschutes	3400	2500	3700	4200	5000	3800	3600	2900	3800	3500	3600	3500
Winema	1400	800	2200	3300	2900	3700	4500	4600	4500	3800	3200	4200
Rogue River	2900	1300	2900	2500	3500	2900	3300	3700	3800	2200	2900	3200
Siskiyou	1500	600	1600	2100	2100	2800	4000	3400	3900	1900	2400	3200
Oregon Subtotal:	27000	17500	32100	36800	40500	41600	48700	47200	46900	32000	37100	43300
Shasta-Trinity	2100	1200	3100	2600	2900	2700	2700	3500	2300	2900	2600	2800
Klamath	2000	1100	1500	2300	1800	2600	2800	2900	3500	2500	2300	2900
Mendocino	900	500	800	1300	1100	1000	1000	1600	1300	700	1000	1100
Six Rivers	2000	1000	2200	2400	2700	2400	3100	3500	3400	1600	2400	2800
California Subtotal:	7000	3800	7600	8600	8500	8700	9600	11500	10500	7700	8300	9600
Total <sup>1:</sup>	49400	31700	56500	63800	66700	68800	79100	80100	75300	52100	62400	71000

<sup>1</sup> Rounded to nearest 100 jobs; therefore, may not add to total shown.

**Figure 3&4 – 32 Historic Employment Levels**

Historic employment levels generated by National Forest timber harvests in thousands of jobs per year.



**Table 3&4 – 36 Historic Income Levels**

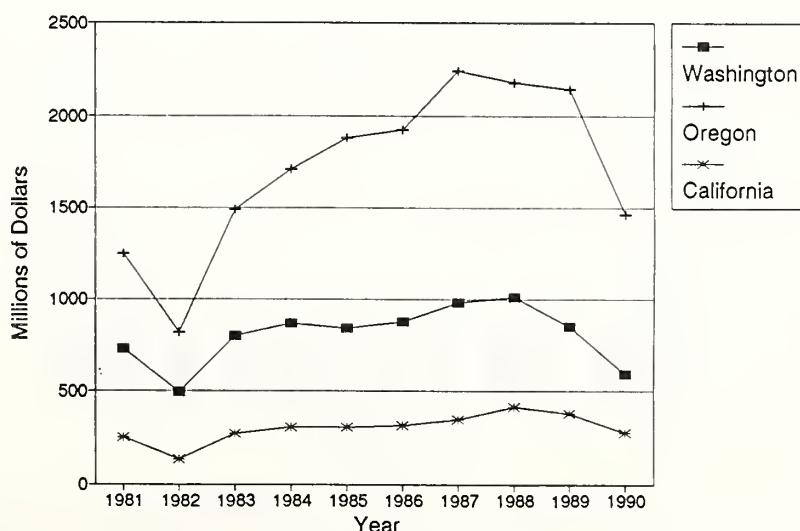
Historic income levels generated by National Forest timber harvests in millions of dollars per year.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	10-Year Avg	Last 5-yr avg
Olympic	168.4	120.6	180.7	229.5	179.5	181.0	180.0	195.4	143.8	86.3	166.5	157.3
Mt. Baker-Snoqualmie	192.5	113.2	196.6	214.2	191.7	235.4	269.1	225.5	171.5	123.4	193.3	205.0
Gifford Pinchot	185.4	172.0	260.0	251.5	268.7	244.2	294.5	362.4	313.1	220.9	257.3	287.0
Okanogan	50.1	11.6	48.4	33.6	38.4	42.1	68.6	82.2	71.9	32.0	47.9	59.4
Wenatchee	133.1	78.1	112.5	143.1	165.1	175.1	171.0	144.2	152.3	133.6	140.8	155.3
Washington Subtotal:	729.5	495.5	798.2	871.9	843.4	877.9	983.1	1009.8	852.7	596.1	805.8	864.0
Siuslaw	163.9	74.2	180.8	226.1	203.4	210.1	241.1	280.9	210.0	116.3	190.7	211.7
Mt. Hood	190.9	121.5	246.1	265.7	275.2	283.8	279.1	273.0	212.0	158.3	230.6	241.2
Willamette	365.0	299.8	430.3	472.8	601.2	588.1	697.5	719.8	666.0	415.1	525.6	617.3
Umpqua	122.8	84.4	166.3	203.2	195.1	250.9	343.7	256.8	364.1	267.4	223.7	293.0
Deschutes	152.5	114.9	167.1	192.2	229.3	174.8	161.8	131.0	171.8	156.7	165.2	159.3
Winema	61.9	37.5	99.9	152.1	131.0	171.5	204.5	210.2	207.7	172.8	144.9	193.3
Rogue River	134.8	59.4	134.0	114.3	163.0	135.7	152.8	171.9	175.2	100.8	134.2	147.3
Siskiyou	57.7	24.8	64.7	84.3	82.9	110.5	158.8	135.9	152.6	75.8	94.8	126.7
Oregon Subtotal:	1249.5	816.4	1489.4	1710.7	1881.2	1925.5	2239.4	2179.5	2141.5	1463.3	1709.6	1989.8
Shasta-Trinity	77.7	42.6	115.0	96.6	106.2	101.3	100.0	129.8	84.5	106.7	96.0	104.5
Klamath	73.7	39.1	54.0	83.4	67.2	97.8	104.5	109.1	131.3	94.1	85.4	107.4
Mendocino	31.6	16.7	30.7	46.5	39.1	36.5	35.9	59.2	48.1	25.2	37.0	41.0
Six Rivers	67.7	34.4	75.4	80.7	90.8	80.8	105.2	118.8	115.8	53.0	82.3	94.7
California Subtotal:	250.7	132.7	275.1	302.7	303.2	316.5	345.7	416.8	379.7	278.9	300.7	347.5
Total <sup>1</sup> :	2229.7	1444.6	2562.6	2889.8	3027.8	3119.9	3568.2	3606.1	3374.0	2338.3	2816.1	3201.3

<sup>1</sup> Rounded to nearest \$100,000; therefore may not add to total shown.

**Figure 3&4 – 33 Historic Income Levels**

Historic income levels generated by National Forest timber harvests in millions of dollars per year.



## The Affected Environment and Environmental Consequences

**Table 3&4 – 37 Projected Total Employment**

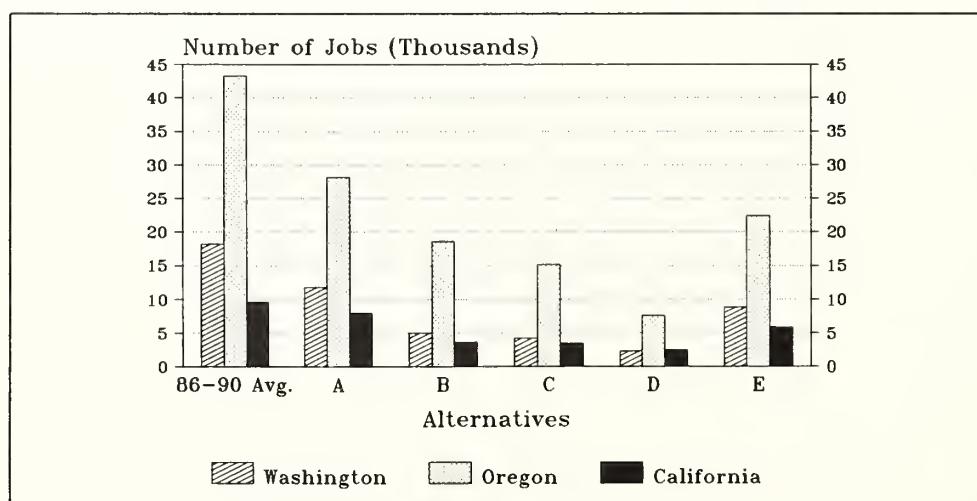
Projected total employment generated by National Forest timber harvest in jobs per year.

	Alt. A (1995)	Alt. B (1995)	Alt. C (1995)	Alt. D (1995)	Alt. E (1995)
Olympic	1800	300	200	200	1800
Mt. Baker-Snoqualmie	2100	600	500	400	1300
Gifford Pinchot	4800	2400	1900	500	3200
Okanogan	900	800	800	800	900
Wenatchee	2200	900	800	400	1600
Washington Subtotal <sup>1</sup> :	11800	5000	4200	2300	8800
Siuslaw	4500	2300	1600	800	3200
Mt. Hood	2600	1900	1100	1200	1700
Willamette	8300	4600	3600	1800	6200
Umpqua	4700	3700	3300	400	4100
Deschutes	1700	1300	1200	1000	1700
Winema	2000	2000	2000	1800	2000
Rogue River	1900	800	700	400	1200
Siskiyou	2500	2000	1700	200	2300
Oregon Subtotal <sup>1</sup> :	28200	18600	15200	7600	22400
Shasta-Trinity	2700	1000	900	800	1400
Klamath	1700	1200	1100	800	1700
Mendocino	1000	300	300	200	800
Six Rivers	2600	1200	1200	700	2000
California Subtotal <sup>1</sup> :	8000	3700	3500	2500	5900
Total All Forests <sup>1</sup> :	48000	27300	22900	12400	37100

<sup>1</sup> Rounded to nearest 100 jobs; therefore may not add to total shown.

**Figure 3&4 – 34 Projected Total Employment**

Projected total employment generated by National Forest timber harvest in jobs per year.



**Table 3&4 – 38 Projected Income**

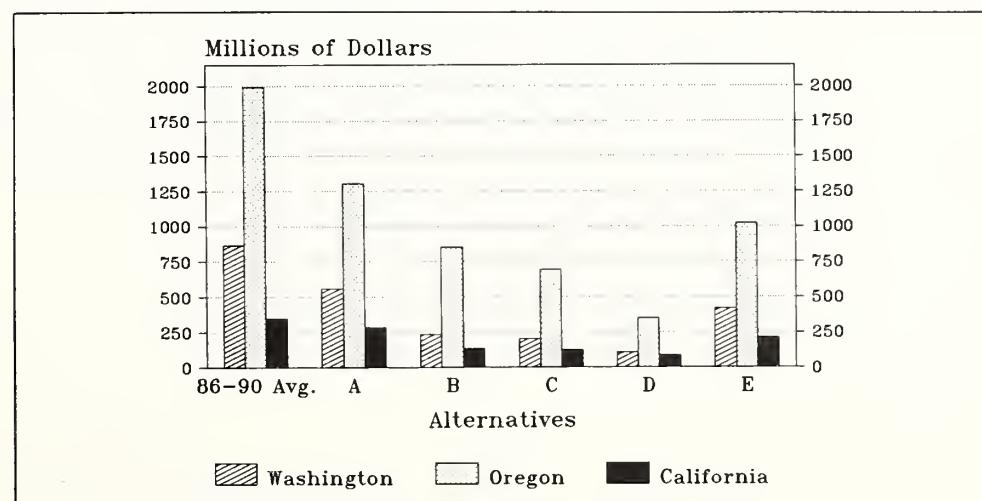
Projected income generated by National Forest timber harvest in millions of dollars per year.

	Alt. A (1995)	Alt. B (1995)	Alt. C (1995)	Alt. D (1995)	Alt. E (1995)
Olympic	82.1	14.8	11.1	10.4	82.8
Mt. Baker-Snoqualmie	98.2	29.1	24.5	18.2	61.8
Gifford Pinchot	235.4	117.0	92.3	24.0	155.8
Okanogan	38.8	34.5	34.5	34.5	38.8
Wenatchee	105.1	41.7	38.6	20.1	77.3
Washington Subtotal <sup>1</sup> :	559.6	237.1	201.1	107.1	416.5
Siuslaw	221.9	113.9	76.2	38.4	156.3
Mt. Hood	129.8	94.8	57.7	58.4	83.3
Willamette	380.7	213.2	165.2	81.4	286.9
Umpqua	208.0	163.8	143.2	19.3	180.6
Deschutes	78.7	57.5	56.7	46.4	77.1
Winema	93.8	93.8	91.4	80.2	93.0
Rogue River	90.1	37.5	33.8	16.5	54.8
Siskiyou	100.8	79.3	68.6	6.3	90.7
Oregon Subtotal <sup>1</sup> :	1303.9	854.0	692.8	347.0	1023.3
Shasta-Trinity	98.3	37.3	34.2	29.0	50.9
Klamath	62.3	45.2	42.1	28.5	63.6
Mendocino	36.9	11.0	10.1	7.5	30.7
Six Rivers	89.0	40.4	39.8	24.3	67.1
California Subtotal <sup>1</sup> :	286.5	133.8	126.2	89.3	212.3
Total All Forests <sup>1</sup> :	2150.0	1224.9	1020.2	543.4	1652.1

<sup>1</sup> Rounded to nearest \$100,000; therefore, may not add to total shown.

**Figure 3&4 – 35 Projected Income**

Projected income generated by National Forest timber harvest in millions of dollars per year.



## **Timber Generated Employment From Other Land Owners**

A significant amount of the total employment in the forest products industry is generated by timber harvests from lands other than National Forests. Historically, harvest from other ownerships has been more than double the amount harvested from National Forests. Therefore, almost two thirds of the total forest industry employment in Washington, Oregon, and California has come from harvests outside the National Forests. Table 3&4 – 39 displays the total impact anticipated from all timber harvests, including a breakdown of jobs generated from Forest Service and other land managers' timber harvests. It should be noted that Forest Service employment shown in the table below includes employment generated by timber harvests from all National Forests in Washington, Oregon, and California not only the Forests impacted by the northern spotted owl as shown in the previous table.

**Table 3&4 – 39 Projected Employment Generated From Timber Harvest in thousands of jobs**

Projected employment generated from timber harvest in Washington, Oregon, and California, in thousands of jobs, by land managers.

Land Manager	Historic 5-year average	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Forest Industry	99.4	83.0	84.9	86.3	89.0	83.2
Forest Service	89.0	71.9	52.5	45.2	35.7	61.9
Other Government	29.3	26.4	26.4	26.4	26.4	26.4
Other Private	18.3	29.2	31.3	32.7	35.5	29.6
Total	236.0	210.5	199.6	190.6	186.6	201.1

## **Employment From Recreation and Tourism**

It is possible that there could be some positive impacts on employment and income from changes in recreation use created by spotted owl habitat management. Even though the subspecies does not directly provide additional recreational use, protection of its habitat does provide recreational opportunities. Designated areas managed primarily for spotted owl habitat will provide for future primitive recreation opportunities. However, harvested lands also accommodate certain recreation activities, such as deer hunting or off-road vehicle use. Without considerable additional research and analysis, it can not be determined if designation of areas managed primarily for spotted owl habitat would increase or decrease total recreation use. Therefore since it is not possible at this time to determine the net change in total recreation use, it is not possible to estimate the effects this recreation use would have on employment and income.

## Revenues

---

### Affected Environment

National Forest timber harvest throughout the range of the spotted owl is an important source of revenue in terms of returns to the Federal Treasury.

The past revenues generated from National Forest timber harvests for the 17 National Forests included in this analysis are shown in Table 3&4 – 40 and Figure 3&4 – 36. The table displays the actual revenue generated from each Forest over the last 5 years. It also displays the average yearly revenue generated between 1986 and 1990. These figures are designed to provide an historic reference for use in evaluating the alternatives, especially Alternative A which is used as a baseline for comparison of the remaining four alternatives.

Total revenue generated by timber harvests from National Forests within the range of the northern spotted owl has averaged \$822.2 million per year over the previous 5 years. The high point during that period was reached in 1986 when total revenue rose to \$938.7 million. The lowest amount of revenue generated occurred in 1987 when \$687.5 million was generated.

In the State of Washington, revenue generated by the harvesting and processing of National Forest timber has averaged \$165.2 million per year over the last 5 years. The lowest amount of revenue generated occurred in 1987 when \$135.8 million was generated. The highest level of the last 5 years was reached in 1988 when revenues reached \$186.3 million. Since 1988, revenue levels have declined nearly 11 percent to \$146.6 million in 1990.

Of the 17 National Forests included in this analysis, those in Oregon have the largest amount of revenue generated by timber harvesting. In Oregon, revenue has averaged \$565 million per year over the last 5 years. The highest revenue level during that time occurred in 1986 when \$689.3 million was generated. The lowest revenue level was generated in 1987 when \$467.6 million was returned to the United States Treasury.

In northern California, revenue generated by harvesting of National Forest timber averaged \$91.9 million per year over the last 5 years. The highest revenue during that time was in 1989 when \$109.5 million was generated. The low point during the last 5 years was in 1986 when only \$70.4 million in revenue was generated.

## **Environmental Consequences**

Revenues returned to the Federal Treasury are assumed to vary according to changes in timber harvest levels and stumpage prices. As timber harvest levels decline, revenues are expected to decline as well. These declines, however, will be somewhat offset by increases in stumpage values caused by the reduction in timber supplies. It is anticipated, however, that increases in stumpage prices will not be sufficient to offset the reduction in harvests in Oregon and Washington. In California, however, anticipated price increases should compensate for harvest reductions to prevent declines in revenues. In the event the anticipated price increases do not occur, a comparison of the relative differences between the alternatives is still valid. The projections for future revenue generated by timber harvests from the 17 National Forests included in this analysis are displayed in Tables 3&4 – 41 and 42, and summarized for the three states in Figure 3&4 – 37. These estimates were made using recent prices and projected changes in stumpage prices from the Timber Assessment Market Model analysis discussed in Appendix B.

**Alternative A.** Alternative will potentially generate the largest amount of revenue associated with National Forest timber harvesting. It will provide \$940.1 million in returns to the Federal Treasury. Alternative A forms the baseline for comparing the other four alternatives.

**Alternative B.** The total revenue associated with National Forest timber harvests in Alternative B is projected to be \$644.7 million in 1995. This is a potential reduction from Alternative A of 31 percent.

**Alternative C.** The total revenue associated with National Forest timber harvests in Alternative C is projected to be \$507.2 million in 1995. This is a potential reduction from Alternative A of 46 percent.

**Alternative D.** The total revenue associated with National Forest timber harvests in Alternative D is projected to be \$350.7 million in 1995. This is a potential reduction from Alternative A of 63 percent.

**Alternative E.** The total revenue associated with National Forest timber harvests in Alternative E is projected to be \$765.6 million in 1995. This is a potential reduction from Alternative A of 19 percent.

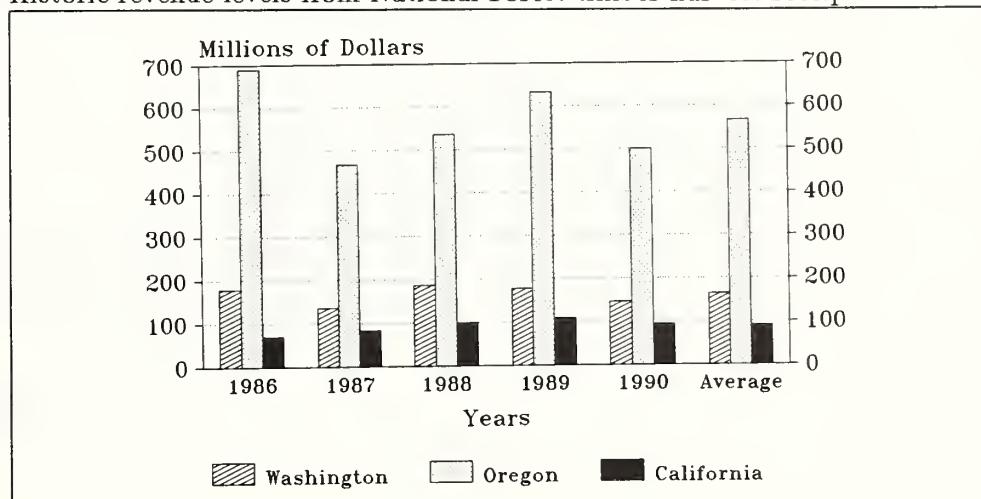
**Table 3&4 – 40 Historic Revenue Levels**

Historic revenue levels from National Forest timber harvest receipts in millions of dollars per year.

	1986	1987	1988	1989	1990	5-Year Average
Olympic	33.1	24.3	35.2	28.6	24.3	29.1
Mt. Baker-Snoqualmie	45.8	29.8	36.2	35.1	32.9	36.0
Gifford Pinchot	70.3	58.7	86.3	81.1	64.5	72.2
Okanogan	7.3	6.8	10.3	12.3	6.1	8.6
Wenatchee	22.5	16.2	18.3	21.4	18.8	19.4
Washington Subtotal:	179.0	135.8	186.3	178.5	146.6	165.2
Siuslaw	118.9	58.0	80.2	80.1	53.8	78.2
Mt. Hood	98.1	53.5	69.3	61.3	59.4	68.3
Willamette	188.7	136.2	160.8	187.4	147.4	164.1
Umpqua	68.5	82.9	70.4	124.8	109.4	91.2
Deschutes	57.7	30.3	26.4	24.3	26.8	33.1
Winema	64.8	35.6	47.8	54.2	37.7	48.0
Rogue River	56.0	36.3	40.5	44.4	29.1	41.3
Siskiyou	36.6	34.8	40.1	56.5	36.0	40.8
Oregon Subtotal	689.3	467.6	535.5	633.0	499.6	565.0
Shasta-Trinity	26.5	29.8	39.2	32.3	46.9	34.9
Klamath	21.3	24.1	21.1	31.7	20.2	23.7
Mendocino	9.9	9.7	18.4	13.2	9.3	12.1
Six Rivers	12.7	20.5	22.4	32.3	18.1	21.2
California Subtotal:	70.4	84.1	101.1	109.5	94.5	91.9
Total All Forests:	\$938.7	\$687.5	\$822.9	\$921.0	\$740.7	\$822.2

**Figure 3&4 – 36 Historic Revenue Levels**

Historic revenue levels from National Forest timber harvest receipts.



*The Affected Environment and Environmental Consequences*

**Table 3&4 – 41 Projected Total Revenues**

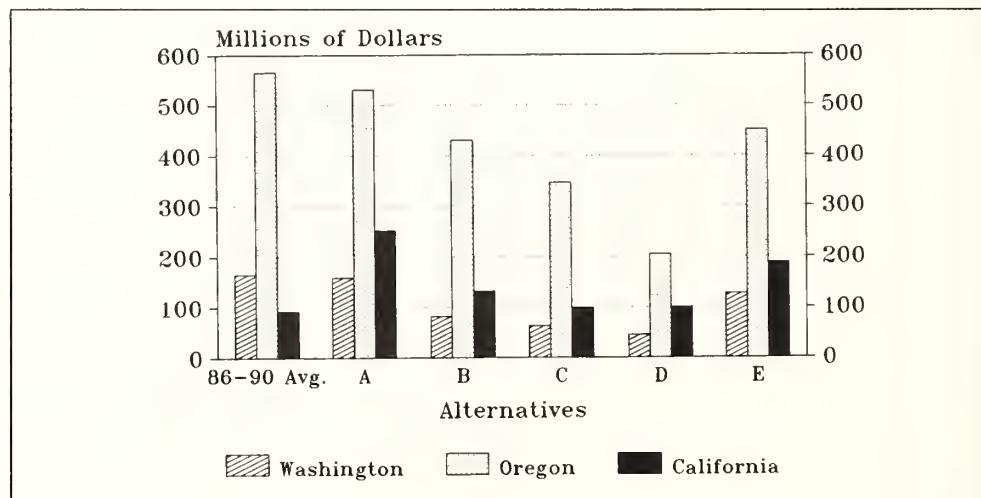
Projected total revenues generated by National Forest timber harvest receipts in millions of dollars per year.

	Alt. A revenue (1995)	Alt. B revenue (1995)	Alt. C revenue (1995)	Alt. D revenue (1995)	Alt. E revenue (1995)
Gifford Pinchot	74.9	47.1	32.1	13.1	54.6
Mt. Baker-Snoqualmie	28.6	10.7	9.1	9.1	19.8
Okanogan	9.8	9.7	9.8	12.2	9.7
Olympic	25.2	5.8	3.9	5.5	28.0
Wenatchee	19.7	8.8	8.0	5.3	14.4
WA Subtotal <sup>1</sup> :	158.2	82.1	62.9	45.1	126.5
Deschutes	17.9	14.7	14.9	14.9	17.4
Mt. Hood	53.1	49.1	38.2	41.0	37.7
Rogue River	28.4	15.0	13.8	8.9	19.0
Siskiyou	52.2	52.1	45.8	5.6	51.7
Siuslaw	111.9	72.7	51.2	33.2	86.8
Umpqua	92.7	92.5	77.5	14.8	88.7
Willamette	147.3	104.4	74.7	54.0	122.2
Winema	27.2	30.5	30.0	32.7	26.8
Oregon Subtotal <sup>1</sup> :	530.8	430.9	346.1	205.1	450.3
Klamath	33.4	29.1	23.9	20.5	36.7
Mendocino	33.9	12.1	10.8	9.2	30.4
Shasta-Trinity	108.1	49.2	30.7	42.8	60.2
Six Rivers	75.8	41.3	32.8	27.9	61.5
CA Subtotal <sup>1</sup> :	251.2	131.6	98.2	100.4	188.8
Total <sup>1</sup> :	\$940.1	\$644.7	\$507.2	\$350.7	\$765.6

<sup>1</sup> Rounded to nearest 100,000; therefore, may not add to total shown.

**Figure 3&4 – 37 Projected Total Revenues**

Projected total revenues generated by National Forest timber harvest receipts.



**Net revenues.** Net revenues generated from National Forest timber harvests are projected for each alternative in Table 3&4 – 42. Net revenues are defined as the gross timber revenues previously displayed in this chapter, minus the cost associated with producing that timber. All of the National Forests included in this analysis are anticipated to produce a positive net return to the Federal Treasury, in all alternatives. This means the revenues generated by timber harvest will exceed their cost of production. Alternative A will produce the highest net revenue. Alternatives E, B, C, and D will progressively reduce the net revenues.

**Table 3&4 – 42 Projected Net Revenues**

Projected net revenues generated by National Forest timber harvest receipts in millions of dollars per year.

	Alt. A revenue (1995)	Alt. B revenue (1995)	Alt. C revenue (1995)	Alt. D revenue (1995)	Alt. E revenue (1995)
Gifford Pinchot	54.5	37.0	26.0	11.0	41.1
Mt. Baker-Snoqualmie	21.5	8.6	7.5	7.8	15.3
Okanogan	4.7	5.2	5.4	7.7	4.6
Olympic	12.7	3.6	2.6	3.9	15.4
Wenatchee	10.7	5.2	4.9	3.6	7.8
WA Subtotal <sup>1</sup> :	104.2	59.5	46.4	34.0	84.3
Deschutes	12.0	10.4	10.7	11.4	11.6
Mt. Hood	37.2	37.5	30.2	33.8	27.4
Rogue River	18.7	10.9	10.5	7.1	13.1
Siskiyou	30.8	35.2	32.7	4.3	32.4
Siuslaw	92.6	62.8	45.0	29.9	73.2
Umpqua	77.4	80.4	68.6	13.4	75.4
Willamette	117.3	87.64	64.1	47.6	99.6
Winema	21.3	24.6	24.5	27.7	21.0
Oregon Subtotal <sup>1</sup> :	407.3	349.5	286.2	175.1	353.7
Klamath	20.1	19.5	16.4	14.4	23.2
Mendocino	25.9	9.7	8.8	7.6	23.7
Shasta-Trinity	89.4	42.1	26.5	37.3	50.5
Six Rivers	63.7	35.8	28.7	24.6	52.4
CA Subtotal <sup>1</sup> :	199.1	107.1	80.4	83.9	149.8
Total <sup>1</sup> :	\$710.6	\$516.2	\$413.1	\$293.0	\$587.8

<sup>1</sup> Rounded to nearest 100,000; therefore, may not add to total shown.

This page left blank for notes.

## Payments to Counties

---

### Affected Environment

National Forest timber harvest throughout the range of the spotted owl is an important source of payments to counties.

Payments to counties is a form of revenue sharing in which 25 percent of the revenues collected on the National Forests are returned to the counties for use in funding roads and schools. These funds from each Forest are distributed to the counties within that Forest, based on their percentage of the total acreage. The past payments to counties are shown in Table 3&4 – 43 and Figure 3&4 – 38. These display the actual payments to counties, by county, over the last 5 years and the average between 1986 and 1990.

Payments to counties generated by timber harvests from National Forests within the range of the northern spotted owl has averaged \$205.7 million per year over the previous 5 years. The high point during that period was reached in 1986 when payments to counties rose to \$234.7 million. The lowest amount of payments generated occurred in 1987 when payments to counties were \$172.1 million.

In the State of Washington, payments to counties generated by the harvesting and processing of National Forest timber has averaged \$41.4 million per year over the last 5 years. The lowest amount of payments generated occurred in 1987 when payments to counties were \$34.1 million. The highest level of the last 5 years was reached in 1988 when payments to counties were \$46.7 million. Since 1988, payments to counties declined nearly 21 percent to \$36.6 million in 1990.

Of the counties included in this analysis, those in Oregon have the largest payments to counties generated by timber harvesting. In Oregon, payments to counties averaged \$140.1 million per year over the last 5 years. The highest payment level during that time occurred in 1986 when payments to counties rose to \$170.8 million. The lowest payment level was in 1987 when counties received \$116.0 million.

In northern California, payments to counties generated by harvesting of National Forest timber averaged \$24.2 million per year over the last 5 years. The highest payment during that time was in 1989 when payments to counties rose to \$28.8 million. The low point during the last 5 years was reached in 1986 when payments to counties were only \$19.1 million.

## **Environmental Consequences**

Payments to counties are assumed to vary according to changes in timber harvest levels and stumpage prices. As timber harvest levels decline, payments to counties are expected to decline as well. These declines, however, will be somewhat offset by increases in stumpage values caused by the reduction in timber supplies. It is anticipated, however, that increases in stumpage prices will not be sufficient to offset the reduction in harvests in Oregon and Washington. In California, however, anticipated price increases should compensate for harvest reductions to prevent declines in payments to counties. In the event the anticipated price increases do not occur, a comparison of the relative differences between the alternatives is still valid. The projections for future payments to counties generated by timber harvests from the 17 National Forests included in this analysis are displayed by county in Table 3&4 – 44, and summarized for the three states in Figure 3&4 – 39. These estimates were made using recent prices and projected changes in stumpage prices from the Timber Assessment Market Model analysis discussed in Appendix B.

**Alternative A.** Alternative A will potentially generate the largest amount of payments to counties associated with National Forest timber harvesting. Alternative A forms the baseline for comparing the remaining four alternatives.

For the State of Washington, timber harvesting under Alternative A will generate approximately \$39.4 million in payments to counties in 1995. This represents a reduction of 4 percent from the historic average over the last 5 years. The largest amount of payments will go to Skamania County which should receive \$12.2 million.

Timber harvesting under Alternative A in Oregon could generate about \$131.8 million in payments to counties in 1995. When compared to the average levels over the last 5 years, this represents a reduction of 6 percent by 1995. The largest amount of payments will go to Douglas and Lane Counties which will receive \$24.9 million and \$32.4 million respectively.

For the four National Forests in northern California, this alternative could generate \$63.8 million in payments to counties in 1995. From the average over the last 5 years, this represents an increase of 173 percent. This is the result of stumpage prices increasing at a faster rate than the rate of decline of harvest levels in California. Trinity County will receive the largest amount of payments, amounting to \$21.3 million.

**Alternative B.** The total payments to counties associated with National Forest timber harvests in Alternative B is projected to be \$164.1 million. This is a potential reduction from Alternative A of 30 percent.

For the State of Washington, timber harvesting under Alternative B could generate payments to counties of \$20.5 million. This would be an overall reduction from Alternative A of 48 percent. Those counties with a reduction in payments from Alternative A of more than \$2 million

include: Chelan (\$2.2 million), Jefferson (\$2.2 million), Lewis (\$2.1 million), and Skamania (\$4.5 million). Okanogan is the only county which will remain unaffected.

In Oregon, Alternative B could generate \$112.0 million in payments to counties. This would be an overall reduction of 15 percent in 1995 from Alternative A. Those counties with a reduction in payments of more than \$2 million include: Curry (\$3.1 million), Jackson (\$2.2 million), Lake (\$3.9 million), Lane (\$9.1 million), and Linn (\$3.1 million). Josephine and Klamath Counties will see a slight increase in payments to counties due to timber stumpage prices increasing at a faster rate than the rate of decline of harvest levels.

For the four National Forests in northern California, timber harvests could generate payments to counties of \$31.2 million. This would be a 50 percent overall reduction from Alternative A. Those counties with a reduction of more than \$2 million include: Del Norte (\$3.8 million), Humboldt (\$3.3 million), Shasta (\$2.9 million), Siskiyou (\$4.9 million), and Trinity (\$11.7 million).

**Alternative C.** The payments to counties associated with National Forest timber harvests in Alternative C is projected to be \$133.8 million in 1995. This is a potential reduction from Alternative A of 43 percent.

For the State of Washington, timber harvesting under Alternative C could generate about \$17.0 million in payments to counties by the year 1995. This would be an overall reduction from Alternative A of 57 percent. Four counties will experience a reduction of more than \$2 million. These counties include: Chelan (\$2.7 million), Jefferson (\$2.4 million), Lewis (\$2.8 million), and Skamania (\$6.0 million). Okanogan County will experience a slight increase in payments due to timber stumpage prices increasing at a faster rate than the rate of decline of harvest levels.

In Oregon, Alternative C could generate \$88.2 million in payments to counties. This would be a reduction of 33 percent. Six counties will experience a decline in payments of more than \$2 million, including: Clackamas (\$2.8 million), Douglas (\$5.2 million), Jackson (\$2.3 million), Lake (\$4.0 million), Lane (\$14.1 million), and Linn (\$5.3 million).

For the four National Forests in northern California, the timber harvests under Alternative C could generate payments to counties of \$28.6 million. This would be a 55 percent reduction from levels expected by 1995 under Alternative A. Five counties will experience a decline of more than \$2 million. These counties are Del Norte (\$4.3 million), Humboldt (\$3.4 million), Shasta (\$3.1 million), Siskiyou (\$5.8 million), and Trinity (\$12.7 million).

**Alternative D.** The total payments to counties associated with National Forest timber harvests in Alternative D are projected to be \$87.7 million in 1995. This is a potential reduction from Alternative A of 63 percent.

## *The Affected Environment and Environmental Consequences*

For the State of Washington, Alternative D could generate payments to counties of \$11.4 million in 1995. This would be a potential reduction from Alternative A of 71 percent. Four counties will experience a reduction of more than \$2 million. These counties include: Chelan (\$2.9 million), Jefferson (\$2.2 million), Lewis (\$4.6 million), and Skamania (\$10.0 million). Okanogan County will experience a slight increase in payments due to timber stumpage prices increasing at a faster rate than the rate of decline of harvest levels.

In Oregon, Alternative D could generate \$51.0 million in payments to counties. This would be a reduction of 61 percent in 1995. Nine counties would experience a reduction of more than \$2 million. The largest reduction would be in Douglas County (\$20.2 million), and Linn County (\$21.6 million).

For the four National Forests in northern California the timber harvests under Alternative D could generate payments to counties of \$25.3 million in 1995. This would be a 60 percent reduction from levels expected under Alternative A. Five counties will experience a decline of more than \$2 million. These counties are Del Norte (\$5.5 million), Humboldt (\$4.1 million), Shasta (\$3.1 million), Siskiyou (\$6.5 million), and Trinity (\$13.1 million).

**Alternative E.** The total payments to counties associated with National Forest timber harvests in Alternative E is projected to be \$191.3 million in 1995. This is a potential reduction from Alternative A of 19 percent.

For the State of Washington, Alternative E could generate payments to counties of \$31.5 million in 1995. This would be a potential reduction from Alternative A of 20 percent. Five counties would see a slight increase in payments due to timber stumpage prices increasing at a faster rate than the rate of decline of timber harvests. These counties are Clallam, Grays Harbor, Jefferson, Mason, and Okanogan. Skamania is the only county whose payments would be reduced by more than \$2 million.

In Oregon, Alternative E could generate \$111.7 million in payments to counties. This would be a reduction of 15 percent from Alternative A. Lake and Lane Counties are the only two counties which would experience a reduction of more than \$2 million from Alternative A. They would see reductions of \$2.5 million and \$5.6 million respectively.

For the four National Forests in northern California the timber harvests under Alternative E could generate payments to counties of \$48.1 million in 1995. This would be a 25 percent reduction from levels expected under Alternative A. Shasta and Trinity Counties are the only two counties which would experience a reduction of more than \$2 million. They would see a reduction of \$2.3 million and \$8.0 million respectively from Alternative A.

*Payments to Counties*

**Table 3&4 – 43 Historic Payments to Counties**

Historic payments to counties from National Forest timber receipts in millions of dollars per year.

County Average	1986	1987	1988	1989	1990	
Chelan	4.5	3.3	3.7	4.3	3.8	3.9
Clallam	2.8	2.1	3.0	2.4	2.1	2.5
Cowlitz	0.4	0.3	0.4	0.4	0.3	0.4
Grays Harbor	0.8	0.6	0.9	0.7	0.6	0.7
Jefferson	3.7	2.7	4.0	3.2	2.7	3.3
King	1.3	0.8	1.0	1.0	0.9	1.0
Kittitas	1.4	1.0	1.1	1.3	1.1	1.2
Klickitat	0.2	0.1	0.2	0.2	0.2	0.2
Lewis	5.3	4.4	6.4	6.1	4.8	5.4
Mason	0.9	0.7	1.0	0.8	0.7	0.8
Okanogan	1.8	1.7	2.6	3.1	1.5	2.1
Pierce	0.5	0.3	0.4	0.4	0.3	0.4
Skagit	2.0	1.3	1.5	1.5	1.4	1.5
Skamania	11.4	9.6	14.0	13.2	10.5	11.7
Snohomish	2.4	1.6	1.9	1.8	1.7	1.9
Whatcom	3.2	2.1	2.5	2.5	2.3	2.5
Yakima	2.3	1.6	2.0	1.9	1.7	1.9
WA. Total	44.8	34.1	46.7	44.8	36.6	41.4
Benton	0.9	0.4	0.6	0.6	0.4	0.6
Clackamas	11.5	6.3	8.1	7.2	7.0	8.0
Coos	1.1	0.7	0.9	1.1	0.7	0.9
Curry	5.6	5.3	6.1	8.6	5.5	6.2
Deschutes	8.8	4.6	4.0	3.7	4.1	5.1
Douglas	20.8	21.5	19.6	31.8	27.1	24.2
Hood River	4.9	2.7	3.5	3.1	3.0	3.4
Jackson	9.2	6.2	6.7	7.6	5.0	7.0
Jefferson	1.7	0.9	0.8	0.8	0.8	1.0
Josephine	3.2	2.9	3.3	4.6	2.9	3.4
Klamath	20.6	11.5	14.5	16.1	11.6	14.9
Lake	13.2	6.5	8.6	8.5	6.0	8.5
Lane	38.4	26.9	31.7	37.3	29.1	32.7
Linn	13.7	9.9	11.7	13.6	10.7	11.9
Marion	5.2	3.5	4.3	4.7	3.8	4.3
Multnomah	1.7	0.9	1.2	1.1	1.0	1.2
Tillamook	4.5	2.2	3.0	3.0	2.0	2.9
Wasco	4.7	2.5	3.3	2.9	2.8	3.2
Yamhill	1.2	0.6	0.8	0.8	0.5	0.8
OR. Total	170.8	116.0	132.7	156.9	124.2	140.1
Colusa	0.2	0.2	0.3	0.2	0.2	0.2
Del Norte	1.7	2.5	2.8	4.0	2.3	2.6
Glenn	0.5	0.5	1.0	0.7	0.5	0.6
Humboldt	1.1	1.7	1.9	2.8	1.5	1.8
Lake	0.7	0.7	1.3	1.0	0.7	0.9
Mendocino	0.5	0.5	0.9	0.7	0.5	0.6
Shasta	1.3	1.4	1.9	1.5	2.2	1.7
Siskiyou	7.6	8.0	7.8	10.2	7.7	8.3
Tehema	0.6	0.6	1.0	0.8	0.8	0.8
Trinity	4.9	5.9	7.6	7.0	8.3	6.7
CA. Total	19.1	22.0	26.5	28.8	24.5	24.2
Grand Total	\$234.7	\$172.1	\$205.9	\$230.5	\$185.3	\$205.7

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 44 Projected Payments to Counties**  
 Projected payments to counties in millions of dollars per year.

County	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Chelan	3.9	1.8	1.6	1.0	2.9
Clallam	2.1	0.5	0.3	0.5	2.4
Cowlitz	0.4	0.2	0.2	0.1	0.3
Grays Harbor	0.6	0.1	0.1	0.1	0.7
Jefferson	2.8	0.6	0.5	0.6	3.2
King	0.8	0.3	0.3	0.3	0.5
Kittitas	1.1	0.5	0.4	0.3	0.8
Klickitat	0.2	0.1	0.1	0.0	0.1
Lewis	5.6	3.5	2.4	1.0	4.0
Mason	0.7	0.2	0.1	0.2	0.8
Okanogan	2.4	2.4	2.5	3.1	2.4
Pierce	0.3	0.1	0.1	0.1	0.2
Skagit	1.2	0.5	0.4	0.4	0.8
Skamania	12.2	7.7	5.2	2.1	8.8
Snohomish	1.5	0.6	0.5	0.5	1.0
Whatcom	2.0	0.8	0.6	0.6	1.4
Yakima	1.6	0.8	0.6	0.4	1.1
WA. Total	39.4	20.5	15.8	11.4	31.5
Benton	0.8	0.5	0.4	0.2	0.7
Clackamas	6.3	5.8	4.5	4.8	4.4
Coos	1.2	1.3	0.8	0.2	1.1
Curry	8.0	11.1	7.0	0.9	7.9
Deschutes	2.7	2.3	2.3	2.3	2.7
Douglas	24.9	23.1	19.1	4.7	22.9
Hood River	2.7	2.5	1.9	2.0	1.9
Jackson	4.9	2.7	2.6	1.5	3.4
Jefferson	0.6	0.5	0.5	0.5	0.5
Josephine	4.1	5.6	3.5	0.5	4.0
Klamath	8.5	8.7	8.6	9.2	8.1
Lake	11.4	7.5	5.4	3.6	8.9
Lane	32.4	23.3	17.0	10.8	26.8
Linn	10.7	7.6	5.4	3.9	8.8
Marion	3.7	2.8	2.1	1.7	3.0
Multnomah	0.9	0.9	0.7	0.7	0.7
Tillamook	4.2	2.7	1.9	1.2	3.3
Wasco	2.5	2.3	1.8	1.9	1.8
Yamhill	1.1	0.7	0.5	0.3	0.9
OR. Total	131.8	112.0	85.8	51.0	111.7
Colusa	0.6	0.2	0.2	0.2	0.5
Del Norte	8.5	5.1	3.9	3.0	7.0
Glenn	1.8	0.6	0.6	0.5	1.6
Humbolt	6.5	3.5	2.8	2.4	5.2
Lake	2.5	0.9	0.8	0.7	2.2
Mendocino	1.7	0.6	0.5	0.5	1.5
Shasta	5.1	2.3	1.5	2.0	2.9
Siskiyou	13.6	9.7	7.6	7.1	12.2
Tehema	2.3	0.9	0.7	0.8	1.7
Trinity	21.3	1.0	6.7	8.2	13.3
CA. Total	63.8	33.8	25.3	25.3	48.1
Grand Total	\$235.0	\$166.3	\$126.9	\$87.7	\$191.3

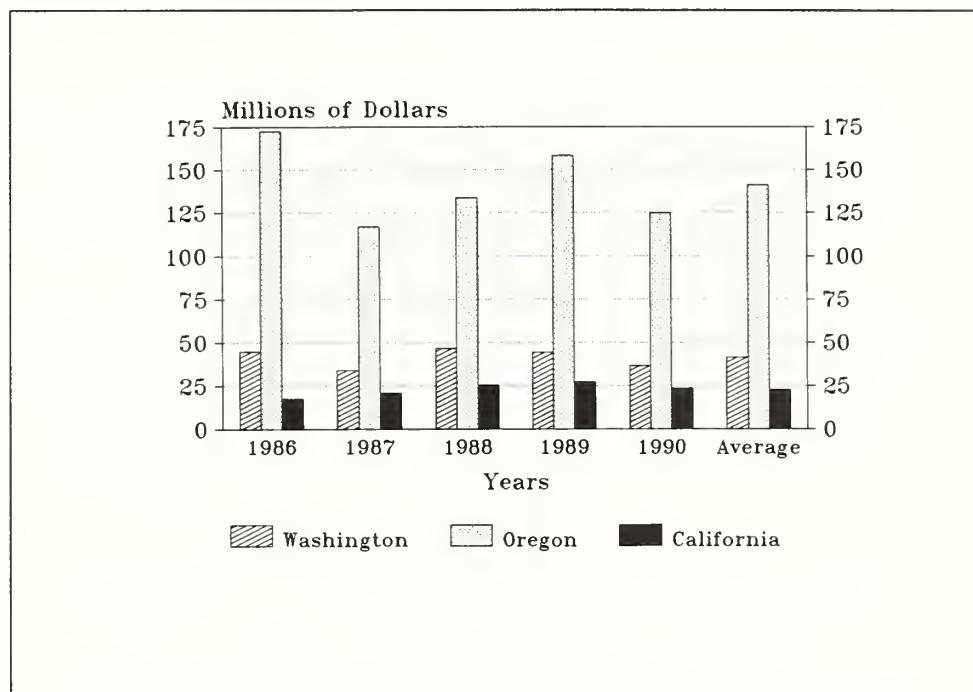
Source: 1990 TSPIRS information.

<sup>1</sup> Rounded to nearest \$100,000; therefore, may not add to total shown.

### *Payments to Counties*

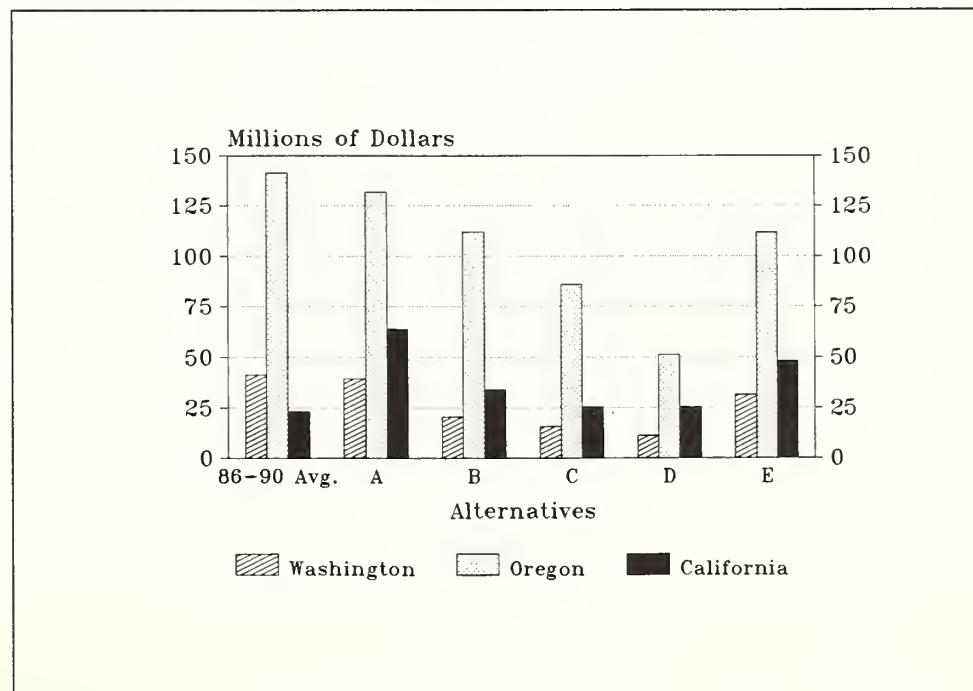
**Figure 3&4 – 38 Historic Payments to Counties**

Historic payments to counties from National Forest timber receipts in millions of dollars per year.



**Figure 3&4 – 39 Projected Total Payments to Counties**

Projected total payments to counties generated by National Forest timber harvest receipts in millions of dollars per year.





## Economic Factors Other Than Timber

---

### Affected Environment

Economic factors other than timber affected by the alternatives are difficult to quantify. Resource activities and projects other than timber harvest may be restricted in designated areas managed primarily for spotted owl habitat. These restrictions could have a negative impact on projects traditionally funded through the timber program.

However, it is assumed for this analysis that activities permitted by the standards and guidelines will occur. These include instream fish habitat rehabilitation, trail maintenance and reconstruction, road maintenance and reconstruction, campground use, campground maintenance and reconstruction, hazard tree felling, and removal of gravel and rock from existing sources.

### Environmental Consequences

There are a number of current or future economic factors that could be affected by the alternatives. The major factors affected include development or expansion of winter sports areas, development of campgrounds and trailheads, mining, economic efficiency measures, and National Forest budgets.

One activity potentially impacted by designation of spotted owl habitat is the development or expansion of winter sports areas. Since these sites typically alter the landscape sufficiently to prevent it from being considered nesting, roosting, and foraging habitat for spotted owls, it is assumed that such activities would not be allowed in designated areas managed primarily for spotted owl habitat.

Alternatives A and E will have minimal impact on the development or expansion of the currently proposed winter sports areas. Alternatives B, C, and D, however, do include areas of potential development in the designated areas managed primarily for spotted owl habitat.

Those winter sports sites potentially impacted by Alternatives C and D include those shown in Table 3&4 – 33. Although these are the known potential sites impacted, the ability to locate future sites may also be progressively restricted in Alternatives B, C, and D.

## *The Affected Environment and Environmental Consequences*

The development of campgrounds and trailheads can also be constrained by the designation of areas managed primarily for spotted owl habitat. These developments typically alter small acreages of landscape sufficiently to prevent them from being considered nesting, roosting, and foraging habitat.

Alternatives A, B, and E generally avoid impacting such areas. Alternatives C and D, however, do include potential developments in the areas they designate for spotted owl habitat. The effects of these recreational developments on spotted owl habitat will need to be examined on a case-by-case basis.

Mining activities can also be restricted by designation of areas managed primarily for spotted owl habitat. Some forms of mining can alter the landscape sufficiently to prevent it from being considered nesting, roosting, and foraging habitat; therefore, it is assumed that such areas may be withdrawn from mineral entry subject to valid existing rights. Even if not withdrawn, increased mitigation costs would decrease the economic viability of operating the mine. Therefore, it is assumed that designation of areas managed primarily for spotted owl habitat would have an adverse effect on the potential development of any mineral resources in that area.

Alternatives A, B, and E generally avoid impacting such areas of mineral potential. Alternatives C and D, however, do include potential mines in the areas they designate for spotted owl habitat.

Economic efficiency measures, such as present net value, internal rate of return, and benefit/cost ratios, are examples of other measures that could be used to evaluate the effects of the alternatives. All of these measures involve calculating the value of outputs that can be quantified and valued, and comparing them with forest management costs. However, most of the outputs associated with the alternatives, other than timber, cannot be both quantified and valued at this time.

Present net value (PNV) is the criteria used by the Forest Service to evaluate economic efficiency. Since none of the 17 National Forests included in this analysis have a below cost timber program, and maximum PNV was the final objective used in establishing timber harvest levels, it can be assumed that PNV will vary in a direct relationship with the timber harvest level of each alternative. This assumption is borne out by Figure 3&4 – 42 which illustrates that “net revenues” from the timber program are all positive and vary in a direct relationship with timber harvest levels. The PNV economic efficiency measure would have the highest value under Alternative A, followed by Alternative E. Alternatives B, C, and D would then have progressively lower PNVs.

National Forest budgets will be affected by the alternatives. Alternative A would have the highest overall budget, and the highest budget

for timber management. Alternatives E, B, C, and D would all have progressively lower overall and timber management budgets. In addition, timber management budgets have traditionally paid for a high portion of general administration costs and wildlife/timber coordination costs. Collections from timber sales have also funded a significant number of wildlife improvement projects in timber sale areas. Under Alternatives E, B, C, and D, appropriations specifically for wildlife management would need to progressively increase to maintain the same level of monitoring and spotted owl habitat management activities that occur under Alternative A.

## Non-Market Contribution

---

### Overview

Undisturbed, mature timber stands may provide some economic benefits to National Forests within the range of the spotted owl. Maintaining these lands in a mature and/or old-growth condition to provide habitat for spotted owls may help sustain these values over time. Many of the values provided by mature timber are not marketed. The lack of market prices makes it difficult to value them in financial terms, as compared to timber harvests, commercial fishing, mining, and other activities which have actual market transactions.

No comprehensive estimate of the benefits of maintaining designated areas managed primarily for spotted owl habitat is feasible with present data. In addition, the production functions which determine the amount of these non-market goods over time are not presently known. Since no estimate of value is available at this time, only the categories of potential values will be discussed in this section. The categories of possible benefits include: recreation, visual resources, fisheries, and existence values.

### Affected Environment

#### Recreation

Recreation benefits arising from spotted owl habitat management include observation or photographic opportunities. The maintenance of undisturbed mature or old-growth forests can also provide for primitive and semi-primitive recreational opportunities.

National Forests that have been managed for timber production still provide many opportunities for recreation such as hunting and off-road vehicle use. However, recreation activities associated with mature forests without road access can provide a different set of recreation opportunities in a more primitive setting. The alternatives' effect on the net change in overall and specific recreation use can not be predicted at this time, nor can the economic effects of those changes.

#### Visual

Scenic quality of the forest is important to the recreation experience in National Forests, according to 95 percent of users (Walsh et al. 1981, 1989). On a 5-point scale, 85 percent report the forest quality is very important at recreation sites, compared to 76 percent on adjacent land in the near view, and 68 percent in the far view. In addition, the correlation between scenic beauty ratings of the forest, and the

economic value of a forest recreation experience is high (Brown et al. 1989). The scenic quality associated with the naturally-appearing mature timber stands maintained for designated areas managed primarily for spotted owl habitat may provide an increasingly important tourist attraction in the long term. Sightseeing is a leading recreation activity on the National Forests and wildlife viewing is a rapidly growing wildlife-related activity in the Nation.

### **Fisheries**

The quality of fisheries may be enhanced by maintenance of designated areas managed primarily for spotted owl habitat. Studies have indicated a positive relationship among fish populations, the catch rate, and the economic value of fishing for salmon in the Columbia River Basin.

### **Existence Values**

Natural ecosystems managed primarily for spotted owl habitat may have an economic benefit beyond the recreation, visual, and fisheries external factors, or side effects, discussed. The public may also be willing to pay for the option of future recreation use, the knowledge that natural ecosystems exist and are maintained, and the satisfaction from its bequest to future generations.

Two recent theoretical studies measuring non-use or preservation values are available for the spotted owl. The results are briefly shown below.

The recently published paper "A Benefit-Cost Analysis of the Northern Spotted Owl", (Rubin et al. 1991) reported values of \$34.84 per household for the residents of Washington State. On this basis, the authors estimated preservation values of \$36.91 per household for Oregon, \$20.88 for California, and \$15.21 for the rest of the United States, aggregating to about \$1.5 billion per year (1987 figures).

*The Affected Environment and Environmental Consequences*

**Table 3&4 – 45 Estimated Existence Value<sup>1</sup>**

	Household willingness to pay	Number of Households (x 1,000)	Aggregate willingness to pay in millions of dollars
Unadjusted Results	\$49.72		
Adjusted results			
Washington	\$34.84	1,801	\$ 62.7
Oregon	\$36.91	1,085	\$ 40.0
California	\$20.88	10,722	\$ 223.9
Subtotal			\$ 326.6
Rest of USA	\$15.21	75,871	\$1,154.0
<b>TOTAL</b>			<b>\$1,481.0</b>

<sup>1</sup>Taken directly from "A Benefit Cost Analysis of the Northern Spotted Owl" (Rubin et al. 1991)

In addition, Hagen et al. (1991) estimated the average person's willingness to pay higher taxes and wood product prices based on a national mail survey of approximately 400 households. The result of the study was an average willingness-to-pay value of \$190 per year. The lower limit of the 98 percent confidence range was \$117 per household. A lower estimate of \$48 per household assumed that the 59 percent of the households who did not respond had a value of zero.

These studies are highly theoretical. The practical test of the Nation's willingness to pay for spotted owl habitat protection will be determined through the legislation and policies directing the management of this habitat

## **Social and Community Effects**

---

### **Introduction**

Changes in the management of the National Forests have effects on people and the families, groups, and communities to which they belong. While predicting the nature and extent of these effects is not as precise as predicting the effects on parts of the natural environment, they are important.

Most people who have participated in the debate over spotted owl management have strong feelings about the different alternatives presented in this environmental impact statement. Selection of any alternative will cause individuals to have feelings of effectiveness (or powerlessness) and satisfaction with (or frustration about) the government, the agency, and the policy process.

Social impacts are those which change communities, institutions, and social and cultural conditions (FSH 1909.17/30.5). The social, community, and cultural changes resulting from implementation of any of these alternatives will be felt almost exclusively in western and central Washington and Oregon and Northwest California, and will be disproportionately intense in rural and timber-dependent areas.

The social effects expected from the alternatives offered in this environmental impact statement are primarily those which flow directly and indirectly from economic changes in the wood products and forestry economic sector. Changes in employment, wages, and the viability of firms has immediate and long-term effects on individuals, families, and communities. Those groups and communities which are more insulated from the economic changes that implementation of these alternatives will cause will experience fewer and less intense social effects.

### **Affected Environment**

The wood products economy has always been a volatile economic sector, and it responds sharply to downturns and upswings in the national economy. The 1980's were a decade of major change in this economic sector, partly due to market forces triggered by changes in the larger economy, and partly due to the widespread increase in the use of technology and automation in wood products manufacturing. For example, employment in the lumber industry in Oregon reached a high in 1979 when 29,000 workers produced over 7 billion board feet of lumber. A low occurred in 1982 when 19,000 workers in Oregon produced less than 5 billion board feet. However, by 1987, just 3,000 more workers (22,000) produced over 8 billion board feet. (Fox 1989: 33).

## *The Affected Environment and Environmental Consequences*

Further changes were anticipated in the 1990's. Beuter (1990: 13) notes:

**"The average annual timber harvest during 1991-2000 for the three-state owl region would likely have declined by 14 percent compared to 1983-1987, irrespective of the Thomas Report and the conservation strategy. This reduction would occur because of the new forest plans on public lands which include significant changes in land use away from timber production in favor of other uses and greater habitat protection for wildlife, including the spotted owl. Reductions on private lands occur because of shortages of merchantable-size timber in some areas, and new environmental restrictions imposed on private timber management by state forest practices regulation."**

**"Associated with the anticipated harvest reductions (from all ownerships) for the three-state owl region is an expected loss of about 19,500 forest industry jobs (a reduction of 13 percent from 1983-1987), and a total loss of about 44,500 jobs throughout the region's economy. It is estimated that about 4,400 jobs would have been lost to technological change, even if harvests remained at 1983-1987 levels, so the net loss attributable to the anticipated harvest reductions (on all ownerships) is 15,100 jobs."**

These changes describe those that would occur with the implementation of Alternative A on National Forests and similar plans on other ownerships.

Even after the reductions reported above, just over 100,000 forest industry jobs would be dependent on timber harvest on all ownerships within the range of the spotted owl (Beuter 1990: 20, 22). This represents about 2.5 percent of jobs in this area and, if current relationships hold, greater than that portion of the area's wage income. These jobs and wages support jobs in other economic sectors. The "multiplier" for the industry is one-half; these 100,000 timber industry jobs are the basis for some 50,000 other jobs in the area's economy

In comparison, the interdisciplinary team's analysis of projected employment from timber industry and other jobs for the three-State owl region, all ownerships, ranges from 210,500 jobs in Alternative A to 186,600 jobs in Alternative D (see "Employment and Income" section, this chapter). Looking at both sets of predictions, the future is not one of employment growth in the forest products industry in the Pacific Northwest and northern California; but, neither is it dead.

**Timber-Dependent Communities.** The social ramifications of the industry is greater than its numerical descriptors. It is located primarily in small cities and towns in the non-metropolitan parts of western and central Washington and Oregon and Northwest California. These communities, usually identified as "timber-dependent communities" are where most of the social and economic impacts of the alternatives will be experienced. About 100 of these communities were identified

in the Interagency Economic Effects Team (USDA Forest Service and USDI Bureau of Land Management, 1990: 62). These are communities where a large share of employment is in the timber industry, the timber industry is dependent on timber from public lands, and other sectors of the economy are not experiencing economic growth (USDA Forest Service and USDI Bureau of Land Management, 1990: 62).

## **Social and Community Effects**

Drawing from sociological studies of timber-dependent communities, interviews with knowledgeable people, and the research literature on job loss and adaptability, Robert G. Lee has written about the social and community effects of implementing the ISC Conservation Strategy (Lee 1990b). The following discussion of social impacts (and later, the impacts of implementing the alternatives) draws principally from his work.

Lee notes that there are three important components in timber-dependent communities: loggers, mill managers and workers, and rural business and service people. Each has adapted to past fluctuations in the timber industry, each will be affected somewhat differently by the changes resulting from implementation of any of these alternatives.

"Loggers are distinguished by an unusual commitment to individualism, hard work, inventiveness, and entrepreneurial spirit (Carroll, in press; and Lee 1990b: 12-14). Carroll characterizes loggers as an "occupational community" more so than a residential community, and notes the central place of their occupation in their sense of self. Loggers are more geographically mobile than others in timber-dependent communities (Lee 1990b: 12-14).

Mill workers are manufacturing workers in a highly cyclical industry and have developed a variety of ways of "riding out" hard times. Long-term workers usually have built strong ties with one mill and one town. Home ownership and family tie them to communities (Lee 1990b: 14-16).

Local business and service owners provide the core of timber-dependent communities, providing much of the community's leadership. They are rooted in the town, tied to communities by the ownership and investment in homes and businesses (Lee 1990b: 16-18).

Lee (1990b) notes four causes of social and cultural disruption in current proposals and the policy dispute about spotted owl habitat management. Along with job losses, he sees impacts from the loss of trust in Federally assured timber supplies, the emergence of open conflict over cultural values, and the negative stereotyping of the people of this industry and these communities.

**Effects of Job Loss.** The effects of job loss are significant. The following excerpt from "Social Impacts of Alternative Timber Harvest

## The Affected Environment and Environmental Consequences

Reductions on Federal Lands in O & C Counties" (Lee et al. 1991: 20-21) lists many of the consequences of job losses:

"Stress resulting from job losses alone can be experienced as a life-threatening event (Lawson 1987) that can have severe consequences for the individual and the community (Linn, et al. 1985). Depression and other mental illnesses are the most frequently observed consequences of unemployment (Linn, et al. 1985; Kasl, et al. 1975; Catalano and Dooley 1981). Individuals with a prior history of mental illness are most susceptible to economic instability, and will be among the first in need of assistance (Ahr, et al. 1981). In fact, lower educational levels are associated with higher use of mental health services (Barling and Handal 1980) indicating that low levels of education limit both options and capacity to be successfully reemployed during periods of economic instability."

"Other manifestations of mental illness, i.e. spouse or child abuse, alcohol and drug abuse, and social conflict also increase in response to rising unemployment (Armstrong and Schulma 1990; Kasl, et al. 1975; Weeks and Drencacz 1983). Increased demands for medical services also accompany economic downturns and unemployment (Kasl, et al. 1975; Catalano and Dooley 1981; Linn, et al. 1985). The reported incidences of heart trouble, hypertension, bone and joint ailments, and chronic headaches all increase during periods of economic instability (D'Arcy and Siddique 1985). People experiencing high levels of stress often suffer from impairment of the cognitive functioning required for retraining or making other changes in their lives. Extreme work-related stresses can produce symptoms resembling the "delayed stress syndrome" from which so many Viet Nam veterans suffered (Lawson 1987). When coupled with stress originating from the blaming of loggers and other wood products workers, loss of way of life, and betrayal by government, many individuals are likely to suffer from both a loss of self-esteem and an impaired capacity to recover (Lifton and Olson 1976; Luchterhand 1971). Their capacity to make rational decisions about retraining, moving, or shifting occupations can be substantially reduced by such an accumulation of stress."

Learned ways of coping with the instability in wood products employment may no longer be adequate. Lee (1990b: 19) observes:

"Loss of a job is by itself often experienced as a life-threatening event, and can be followed by personal trauma and a permanent psychological harm (Lawson 1987 and Briar 1988). Instability in the wood products industry has been so prevalent that people have learned how to cope with losing and regaining jobs. Job security is sought by developing a personal reputation as a good sawmill employee or logger. A sound reputation helps people cope with a cyclical industry, but it leaves people especially helpless when there is massive permanent occupational displacement. As a result, substantial individual and collective trauma can be expected if people are displaced by sudden departures from anticipated harvest schedules, such as is represented by implementation of the ISC strategy."

"Effects on entrepreneurs will be even more severe. People who have invested all their savings and hard work in building a business experience a tremendous loss of self when they are forced to close. Loss of personal business is experienced as a life-threatening event, and can be expected to result in substantial, long-term stress," (Lee 1990b: 19-20).

"In many instances, rural communities exist almost solely because of their link to the processing of the forest resource. The value of homes and businesses are thus vulnerable to changes in resource processing. In that the bulk of many families' net wealth lies in their homes, there is a concern that large changes in harvesting can have greater consequences on families than would be indicated by job displacement alone (Greber 1991: A4). "

Lee also presents the ramifications of the loss of trust in Federal timber supplies, the emergence of class conflict, and negative stereotyping. Each impose a significant emotional impact, and all significantly undermine individual and community efforts to successfully adapt to the changes thrust on timber-dependent communities and their people.

## **Environmental Consequences**

The social effects of the alternatives stem fairly directly from changes in the timber harvest levels of the alternatives. This is not meant to indicate that timber harvest is the only meaningful link between the National Forests and people, but it is the most crucial variable among these alternatives.

Changes in timber harvest level also stand as a surrogate for other measures of economic development in the National Forests (such as mining, developed recreation, and energy development), and as a measure of the level of other forest management activities (such as road construction, tree planting, and vegetation management). There are no economically significant activities in the National Forests which will increase when timber harvests decline. Similarly, none of the social impacts linked to the economic activity of people or communities will be minimized because of declining timber harvests. Beliefs in the widespread sustenance of currently timber-based communities with non-consumptive forest activities and recreation are not well founded.

The first decade's annual timber harvest levels of the alternatives are estimated to be:

Alternative A	3,198 Million Board Feet
Alternative B	1,823 Million Board Feet
Alternative C	1,525 Million Board Feet
Alternative D	809 Million Board Feet
Alternative E	2,457 Million Board Feet

In addition, harvests from forest industry lands will be impacted by the decline in harvest from the National Forests associated with each alternative. The decline in National Forest harvest will lead to an increase in stumpage prices. These higher stumpage prices will lead to

## *The Affected Environment and Environmental Consequences*

higher harvests in the short term from forest industry lands. In the long term, however, these private landowners will have lower harvests as a consequence of reduced inventories (see "Timber Market Effects" section, this chapter). The combination of these market effects will impact communities.

**The Social Effects of Alternative A.** The social effects of Alternative A on timber-dependent communities would continue current patterns in most communities. These communities in the aggregate will need to adapt to a foreseeable decline in timber harvest from all forest ownerships (see the timber harvest projections earlier in this chapter). Some towns will likely be successful during this future; others will experience closed mills and a sparsity of logging activity. The negative impacts described for the other alternatives will be experienced by some people, and some towns, but they will not be as extensive as impacts from market downturns in the past.

**The Social Effects of Alternatives B, C, and D.** The social effects of Alternatives B, C, and D will focus around the implications of community-wide job loss, and the related effects of changes in the management of the National Forests, as discussed above in the "Social and Community Effects" subsection. While it is not possible to quantify the degree of effects to those communities, they will intensify to an extent comparable to the reduction in timber harvest. Where Alternative B is a 43 percent reduction from the future under Alternative A, Alternative C is a 52 percent reduction, and Alternative D is a 75 percent reduction. As timber harvest declines, the social effects will be similar, but even more intense and debilitating to timber-dependent communities.

The effects of Alternatives B, C, and D on non-timber development and management activities will be comparable. However, the effects may not occur with the same suddenness, and workers may have greater geographic mobility and other places to work. Nevertheless, the reduction of these activities will also contribute to the loss of business and activity in rural towns.

The loss of business vitality in rural towns from reductions in timber harvest and other forest development activities compounds the difficulty in providing services, skilled work force, and the quality of life and appearance that will attract new industries and recreational visitors.

An additional impact on some rural communities will be caused by reductions in Forest Service employment and forest management activity. Under Alternative B, an estimated 2,000 to 3,000 Forest Service jobs would be lost (USDA Forest Service, 1991a: 36). Greater reductions are likely under Alternatives C and D.

**The Social Effects of Alternative E.** The social effects of Alternative E in the aggregate are between those of Alternatives A and B. The

timber harvest levels of Alternative E are about half way between the harvest levels for Alternatives A and B; Alternative E is a 23 percent reduction from future levels under Alternative A. By simple interpolation, the effects will on average be about half way between those of Alternatives A and B.

However, effects do not occur as an average. The impacts will be very noticeable in some communities, and not experienced in others. As noted above, the consequences on any particular town will depend on a variety of factors outside the control of the Forest Service, and outside the ability to predict.

### Effects on County Government

Federal agencies control large portions of many counties in the Northwest. In lieu of the property taxes which local governments would collect if the land were privately owned, the Federal Treasury returns 25 (sometimes 50) percent of gross timber sale (and other) receipts to counties to support roads and schools. These funds are a sizable component of the operating budgets for Northwest counties. As noted in the section in this chapter on "Revenue and Payments to Counties" these payments will drop where reductions in timber sale receipts are projected for the alternatives.

These reductions in payments (associated with Alternatives E, B, C, and D, respectively) will occur at a time when county governments—a principal source of social services in rural areas and small towns—are pressed to provide help for a citizenry stressed by downturns in employment.

This decreased ability to provide services, thus compounding the need for them, is discussed in a report to the Association of O & C Counties (Lee et al. 1991: 13-16). They observe:

"Any reduction in social services is likely to have adverse impacts on individuals, families and local communities. This diminished capacity to provide social services is occurring at a time when new demands upon social services will very likely result from sharp increases in the number of people unemployed and dislocated by a decline in the wood products economy. Moreover, these same local social services have been seen as vital for helping communities make a transition from heavy reliance on timber to a more diversified base (Whitelaw and Niemi, 1990), (Lee et al. 1991: 13)."

"These cutbacks in community services tend to erode essential community institutions and the *esprit de corps* of a community, and can result in a weakened sense of pride and identity. Communities suffering from such weaknesses in central institutions (e.g. community colleges, fairs, and museums) are less capable of mobilizing their citizens to voluntarily address

## *The Affected Environment and Environmental Consequences*

common problems resulting from decline in the wood products economy and county revenues. Moreover, individuals and families having difficulty coping with stress are less likely to receive support from neighbors or voluntary associations when the sense of community declines (See Fitchen 1987 and Hibbard 1986), (Lee, et al., 1991: 14-15)."

"Some indication of the magnitude of the social costs associated with economic dislocation can be gained from a recent study of social costs associated with timber industry job losses in Washington State (Rose, 1991). An analysis predicted that total additional social costs in unemployment insurance, welfare, social security, training, wages lost, and taxes lost would total \$165.6 million within the first year for the dislocation of 7,560 timber industry workers. This estimate did not include the increase costs of psychological counseling, law enforcement, education, or loss of asset value in homes, businesses, and equipment. It also did not consider the social costs of indirect job losses, or many of the other less easily measured costs," (Lee, et al., 1991: 15-16).

### **Summary—Social Effects of the Alternatives**

Timber-dependent communities and the wood products industry have experienced many changes. The changes resulting from business cycles, automation, and planned reductions in timber harvest have been met and adapted to with some success. Are the changes that will come from Alternatives B, C, D, and E different from the changes that these communities have seen in the past and had foreseen in the near future?

There is a difference in the permanence of the changes. A market downturn in 1981 and 1982 forced reductions in timber harvest in National Forests in Washington, Oregon, and California to levels roughly similar to those of Alternatives A and B. Those changes were seen as, and were, temporary. Most communities, individuals, and families were able to cope successfully. The changes in timber harvest from Alternatives B, C, and D will last longer than any firm or worker's ability to "wait it out." The changes in timber harvest under Alternative E would have less impact than under Alternative B, but still result in a downturn from the future under Alternative A.

There is a difference in the amount of change. Alternative D would force timber harvest levels lower than experienced in Washington, Oregon, and California in the last two decades.

There is a difference in the source of the change. People in the wood products industry have a strong commitment to the workings of the marketplace—the source of previous changes. The changes of Alternatives B, C, D, and E come through the application of laws and opinions from courts that seem to them insensitive to the economic values forgone and the social disruption that results.

There is a difference in the attitude of the rest of the society. There is a perception that there is little support for the plight of people in the industry and in timber-dependent communities. Lee identifies this antagonism as a case of "blaming the victim" (Lee 1990b: 26).

For these reasons, the changes that will occur to timber-dependent communities and their people from Alternatives B, C, and D are different from previous changes they have experienced and weathered. These communities—loggers, mill owners and workers, and small businesses—and their families will experience significant, long-lasting, impacts that will be difficult to overcome.

### **Opportunities for Mitigation**

Given the severity of these effects, it is natural to look for feasible means to mitigate these consequences. Social scientists have looked at these and find no easy answers.

One proposed solution to the loss of jobs from timber harvest is to increase jobs in secondary manufacturing. Bueuter (1990: 15) observes that because of the nature of final products from Pacific Northwest timber, and (citing Polzin 1990) the higher costs of shipping finished instead of raw materials, it will not be easy to establish more secondary wood products manufacturing in rural areas in the Northwest.

Retraining of woods products workers and loggers to be "good with computers or good with people" will be a difficult undertaking. Lee (1990b) notes many of the reasons this is likely to be difficult to accomplish, noting the centrality of the forest-based work to self-definition and the emotional stress and dysfunction of the change. Also of note is the absence of openings for such new jobs in the towns where displaced workers live.

The expansion of recreational services in depressed timber-dependent communities is not a likely scenario to mitigate the effects of Alternatives B, C, and D. The latter two of these alternatives would themselves substantially restrict the development of recreational facilities on National Forests. And the loss of public and private services in rural towns, and the spread of rural poverty, do not provide a setting attractive to vacationers (Lee 1990b: 32).

Logs from State and private land are currently exported overseas without processing (logs from Federal lands must be sawn or milled before export). The restriction of log exports has been suggested as a way to mitigate the economic and social effects of managing habitat for the spotted owl.

It is not clear, however, that a ban on log exports would directly cause a corresponding increase in volume for domestic processing. The

## The Affected Environment and Environmental Consequences

impact of such a ban would vary depending on the situation faced by each landowner. Some landowners may decide to process that volume through their own existing mills rather than making the volume available to other domestic processors. If mills were already operating at capacity the result would be no net increase in domestic production. Similarly, some landowners may simply choose to delay harvest in response to lower prices. Finally, a ban on log exports is not within the jurisdiction of the Forest Service.

The Interagency Economic Effects Team analyzed the effects of export restriction on the national timber market (USDA Forest Service and USDI Bureau of Land Management, 1990: 62). The effects of restricting log exports are seen as reducing the price of (particularly Douglas-fir) logs and significantly increasing the amount of Douglas-fir lumber produced. However, the net effect on jobs is not quantified, and the necessary new laws would also disrupt established businesses, workers, and communities. The increased harvest of Douglas-fir would mitigate the effects of these alternatives in those communities with access to privately owned and less restricted Federal timber. Not all communities have an economically feasible access to such timber. In addition, timber production of other tree species in the three-State area will drop slightly.

The Department of Agriculture and the Forest Service have a mission "to improve the employment opportunities, incomes, and well-being of the Nation's rural people by strengthening the capacity of rural America to compete in the global economy" (USDA Forest Service, 1990b: 14). Through its existing State and Private Forestry programs, such as The Pacific Northwest Strategy, the Forest Service will continue to help communities diversify and strengthen their economies, improve local services, and enhance the quality of life.

State governments in the affected States have given significant attention to the problems created by ongoing and future changes in the wood products industries. Community and economic development departments offer a variety of informational and economic aid to communities. Other state departments are organized to provide assistance to individuals and families caught in the crisis of change. The magnitude of the change envisioned under Alternatives B, C, and D will stress those agencies as they attempt to mitigate the effects of those changes.

**"Capacity of Counties and States to Mitigate Impacts - ... Counties with a high percentage of land in federal ownership and a large amount of spotted owl habitat will suffer disproportionately from reductions in their share of timber harvest revenue. Yet these are the same counties that will suffer from a reduced tax base and declining economy at a time when they will be obliged to provide increased services for dislocated workers. Mental health and substance abuse treatment, medical care, and law enforcement**

costs will increase dramatically, and will remain at a higher level for up to a decade or more," (Lee 1990b 35).

"Severe financial distress will force may counties to turn to state government for assistance. Supplemental county funding will be needed for at least a decade, since experience shows the social costs of treating dislocated workers continue for years," (Lee 1990b: 35).

## **Minorities, Women, and Civil Rights**

---

### **Minorities and Women**

Racial and cultural minorities constitute a relatively small part of the total population of Washington, Oregon, and northern California. In 1980 African Americans comprised 2 percent of the total population; Hispanics, 2 percent; and American Indians, 1 percent. African Americans in Washington, Oregon, and California live predominantly in urban areas and therefore may not be as prone to economic impacts caused by reductions in timber harvest levels.

A disproportionate number of American Indians and Hispanics live in rural areas when compared to the States' overall populations. An economic downturn in these rural areas created by reductions in timber harvest and forest management work would affect these groups adversely (American Indian religious observances are also affected by the alternatives; those effects are discussed in a later section).

In recent years, women have comprised a larger portion of the labor force in the wood products industry as well as within the Forest Service. Due to their relatively new entry into this work force, their positions are more vulnerable if job reductions occur.

A principal effect of any alternative on minorities and women is directly related to their percentage of the work force and the effect of the alternative on employment. Those alternatives which will have the largest impact on employment will also likely have the largest impact on minorities and women. Alternative A has the lowest potential risk to women and minorities due to its relatively small employment reduction. The largest potential risk to women and minorities is associated with Alternative D.

Within the Forest Service, Alternatives B, C, and D, progressively, would also result in a reduced work force. Affirmative action programs in place would work to protect women and minorities from a disproportionate burden of job losses.

### **Civil Rights**

Civil Rights is defined as "The legal rights of United States citizens to guaranteed equal protection under the law" (USDA Forest Service Manual 1730). None of the alternatives will impact the civil rights of any individual or any identifiable group or category of people.

## **Cultural Resources**

---

Cultural resources are the physical remains of sites, buildings, structures, and objects used by humans in the past that have historical, archaeological, architectural, engineering, or cultural significance. They are material evidence of past ways of life. A wide range of cultural resources is found in the National Forests, including prehistoric sites, buildings, structures, and landscapes representing early settlement, commerce, transportation, mining, lumbering, recreation, and Forest Service history. The Forest Service has a legal responsibility to identify, evaluate, protect, and enhance significant archaeological and historical properties.

As the extent of timber management and other development activities decreases from Alternative A through Alternatives E, B, C, and D, the risk of the damage to many cultural resources is reduced. Historic and archaeological sites have less risk of being damaged. However, as a practical matter, such sites and materials are also less likely to be discovered, recorded, and studied.

## American Indian Religious Sites

---

North American Indian culture is inextricably tied to the land. For centuries, American Indian tribes sought physical and spiritual sustenance from lands that would later be known as Washington, Oregon, and California. Many American Indians traveled hundreds of miles annually, spurred by the changing seasons, the abundance of deer, berries, and fish, and the search for experiences to nourish their souls.

Unlike European cultures whose places of worship have been used almost exclusively for religious practice, the places of worship for the Native American Indian cultures have been simultaneously used for many aspects of life. One place might be the site of berry gathering in late summer, hunting in the fall, and cherished yearlong for the view and setting that would bring them closer to the spirits of the earth.

American Indians have placed a high value on isolated and quiet places for purification, meditation, and vision-questing. The development of the West, including timber harvest and road construction in forests, reduced the number and quality of these religious sites.

The rights of American Indians regarding traditional or cultural uses of land in National Forests are provided for in numerous treaties and in the American Indian Religious Freedom Act of 1978. The Forest Service consults with potentially affected tribes whenever any management activity is proposed in the area of a religious site.

Designated areas managed primarily for spotted owl habitat would restrict timber harvest and road construction, and would therefore provide the most protection for these religious sites. Though such sites are protected by Forest Plans and other agency direction, Alternatives E, B, C, and D would provide progressively more intrinsic protection to the sites as more area is managed primarily for spotted owl habitat and development activities are more limited.

---

## List of Preparers



# List of Preparers

---

The following is a list of contributors to this environmental impact statement. Numerous other Forest Service employees contributed to the completion of this document through their assistance in support functions, and/or by assuming duties of co-workers who were deeply involved in this effort. Their help is greatly appreciated.

## Members of the Interdisciplinary Team

**Jerald N. Hutchins - Team Leader.** Jerry has been with the Forest Service for 33 years, most recently serving as Forest Supervisor on the Eldorado National Forest. He holds a B.S. in Forest Recreation from Colorado State University and has worked as a line officer on various National Forests in the Pacific Northwest, Southwestern, and Pacific Southwest Regions.

**Arnold G. Holden - Assistant Team Leader.** Arnie has worked as a sociologist in planning and environmental coordination for land management agencies for the last 15 years, 13 of them with the Forest Service in the Pacific Northwest Regional Office and in Washington, D.C. He holds a Ph.D. in Sociology from Michigan State University, and his areas of expertise are the National Environmental Policy Act and social effects of land management planning.

**David Arrasmith - Economist.** In his 11 years with the Forest Service, Dave has served as Forest Economist with the Eldorado and Tongass National Forests, as well as Assistant Team Leader on the Tongass National Forest Land Management Team. Dave has a B.S. in Agricultural Economics and Management from the University of California at Davis.

**Kenneth E. Denton - Silviculturist, Timber Management Specialist.** Ken has worked for the Forest Service for 21 years, the last 5 years as Regional Silviculturist for the Pacific Southwest Region. He holds a B.S. in Natural Resources with an emphasis in Forestry from California State University, Humboldt. Ken is a certified silviculturist, and has written numerous agency technical documents during his career with the Forest Service. Ken's areas of expertise are silviculture and Land and Resource Management Plan implementation.

**Jerry Mason - Public Affairs Officer.** In his 21 years with the Federal Government, Jerry has worked in Public Affairs with three agencies: Agricultural Marketing Service in Washington, D.C., Bureau of Land Management in Wyoming and Oregon, and with the Forest Service on the Willamette National Forest and at the Washington, D.C. office. He has a B.S. in Journalism from the University of Oregon.

## *List of Preparers*

**T. Kim Mellen - Wildlife Biologist.** Kim has a B.S. and an M.S. in Wildlife Sciences from Oregon State University and has been with the Forest Service for 5 years. Previous positions include Wildlife Biologist on the Bear Springs Ranger District, Mt. Hood National Forest; and Wildlife Biologist and Resource Assistant for the Powers Ranger District, Siskiyou National Forest. Before joining the Forest Service, Kim spent over two years working for the Oregon Department of Fish and Wildlife.

**Kathy A. O'Halloran - Wildlife Biologist.** For the past 3 years Kathy has worked as the Regional Spotted Owl Monitoring and Inventory Coordinator for the Forest Service's Pacific Northwest Region, a position which has required extensive interaction with other federal and state agencies, primarily the U.S. Fish and Wildlife Service. Kathy holds a M.S. in Biology with a Wildlife emphasis. She has been with the Forest Service for 12 years, including 5 years with the Southern Forest Experiment Station.

**Lyle E. Powers - Operations Research Analyst.** Over the last 14 years Lyle has worked in a variety of resource and computer applications positions with the Forest Service. Prior to joining this team he held the position of Regional Coordinator for Geographic Information Systems (GIS) in the Pacific Northwest Region. His area of expertise is the analysis and management of information and the systems used for the preparation of this environmental impact statement. Lyle holds a B.S. in Forest Resource Management from the University of Idaho.

**Marsha Scutvick - Program Analyst.** Marsha has 18 years of experience with the Forest Service in the Pacific Northwest Region. Prior to joining this interdisciplinary team she served as the Administrative Staff Officer on the Okanogan National Forest. During that time she spent 6 months as Acting Forest Supervisor. Marsha's undergraduate studies include Business and Communications at Seattle University and Eastern Washington University.

## **Scientific Contributors**

**Bruce Marcot - Wildlife Ecologist.** Bruce was a member of the Interagency Scientific Committee and has worked with the Forest Service for 16 years. Previous positions include Regional Wildlife Ecologist at the Pacific Northwest Regional Office, and Area Wildlife Ecologist for the Mt. Hood and Gifford Pinchot National Forests. He has taught at the College of Natural Resources, Humboldt State University. Bruce received a B.S. in Natural Resource Planning and Interpretation and a M.S. in Natural Resource Science from Humboldt State University and holds a Ph.D. in Wildlife Science from Oregon State University.

**Martin G. Raphael - Research Wildlife Ecologist.** Martin has served as the technical advisor for wildlife biology for the preparation of this document. Previous positions include Team Leader for Wildlife Ecology at the Pacific Northwest Research Station in Olympia, Washington, and Project Leader with both the Rocky Mountain Research Station, and the Pacific Northwest Research Station. Martin holds a Ph.D. in Wildland Resource Sciences from the Department of Forestry, University of California, Berkeley. Martin has published over 60 papers on wildlife habitat relationships, community ecology, analytical methods and landscape ecology. He recently served as an Associate Editor of the Wildlife Society Bulletin.

## **Significant Contributors to Analysis**

**Karen Austin - Wildlife Biologist.** Karen holds a B.S. in Zoology from the University of California at Davis and is completing her M.S. in Wildlife Biology from Oregon State University on the subject of goshawk habitat use. In addition to working for the Shasta-Trinity National Forest for the last 7 years, she has worked for various state and conservation organizations, and has participated in research studies. Karen has experience in the areas of raptor population monitoring, radiotelemetry, and habitat management planning.

**Klaus H. Barber - FORPLAN Analyst.** Klaus holds a B.S. in Forest Management from University of California, Berkeley, and an M.B.A. in Business Administration from the University of Southern California. He has 25 years with the Forest Service and is currently the Regional Operational Research/Management Science Specialist at the Pacific Southwest Regional Office in San Francisco.

**Carl R. Frounfelker - Wildlife Biologist.** Carl received a B.S. in Wildlife Management from the University of Wisconsin and a M.S. in Wildlife Management from the University of Idaho. During his 13 years with the Forest Service, Carl has held a District wildlife biologist position on the Flathead National Forest, and Forest biologist positions on the Prescott, Helena and Siuslaw National Forests and in the Regional Office in Missoula, Montana.

**Patricia Greenlee - Wildlife Biologist.** Pat holds a B.S. in Recreation Management from Oregon State University and has been with the Forest Service for 16 years. Previous positions include Wilderness Ranger and Wildlife Technician on the Wallowa-Whitman National Forest and Wildlife Biologist for the Willamette National Forest.

**Richard W. Haynes - Forest Economist.** Richards has a Ph.D. in Forest Economics from North Carolina State and is responsible for social and economic research in Washington, Oregon and Alaska. He is the codeveloper of the Timber Assessment Market Model (TAMM) and provided input on forest markets, price analysis, international trade, and forest sector marketing.

**Cheryl Johnson - Data Analysis.** Cheryl is currently the Forest Analyst and Data Administrator on the Mt. Hood National Forest. She specializes in Paradox data bases and holds a B.S. in Forest Resources from the University of Minnesota. Cheryl has worked in the Pacific Northwest Region for 13 years, including 10 years in forest inventory.

**Rodereck Lamar Kelley - Leader, Public Comment Analysis.** Rodereck is currently the Forest Budget Analyst for the Mt. Hood National Forest. He holds an MA in Public Administration and did undergraduate work in Natural Resources and Business. During his 4 years with the Forest Service he has worked in Forest Planning and Budget and Finance. His area of specialty is Policy Analysis and Judicial Review.

**A. Paul Newman - GIS Analyst.** Paul is an employee with Pacific Meridian Resources, a natural resources consulting firm specializing in geographic information systems (GIS) and remote sensing. He has a B.S. in Forest Management from Oregon State University.

## *List of Preparers*

**Richard H. Phillips - Regional Economist.** Richard holds a B.S. in Forest Management from Colorado State University and has completed graduate studies in Forest Economics. He has 9 years experience with the Forest Service in the Pacific Southwest and Pacific Northwest Regions and is currently the Regional Office Analyst/Economist for the Pacific Northwest Region.

**Diane L. Rainsford - GIS Coordinator.** Diane is a database management specialist with a B.S. in Botany and a B.S. in Forestry, both from Humboldt State University. She has worked as a District Botanist for both the Klamath and Shasta-Trinity National Forests and is currently a Computer Programmer/Analyst for the Redwood Sciences Lab in Arcata, California.

**Allison Reger - Operations Research Analyst.** Allison holds an M.S. in Multi-Resource Management from Northern Arizona University and is currently the Operations Research Analyst for the Willamette National Forest. She has been with the Forest Service for 3 years.

**John R. Steffenson - GIS Specialist.** During his 12 years with various National Forests in the Pacific Northwest Region and the Regional Office John has held positions in Fire, Timber Management, Ecology, Planning, Management Systems, and Engineering. He holds a B.S in Geography from the University of Oregon.

**Marilyn R. Stoll -Wildlife Biologist.** During her 12 years with the Forest Service, Marilyn has worked on the Six Rivers, Olympic and Caribbean National Forests in wildlife, fisheries and other natural resources. She holds a B.S. in Ecology, Ethology, and Evolution from the University of Illinois. Prior to working with the Forest Service, Marilyn restored native tallgrass prairie ecosystems in Illinois, interpreted at Northwest Trek Wildlife Park in Washington, and developed a Farmer's Market as a VISTA volunteer in Tacoma, Washington.

**Robert G. Varner - GIS Analyst.** Bob has a B.S. in Logging Engineering from Oregon State University. In his 11 years with the Forest Service he has worked as an Area Transportation Planner on the Tongass National Forest and as a Transportation Planner and GIS Coordinator on the Gifford Pinchot National Forest.

## **Significant Contributors to Document Preparation**

**Winnie Bailey - Assistant Writer/Editor, Graphics Coordinator.** During her 12 years with the Forest Service Winnie has worked as a writer/editor for a variety of projects including the Snowshoe and Sheep Mountain Resource Recovery Projects, the Ochoco National Forest Land Management Plan, and various projects for the Walla Walla Ranger District on the Umatilla National Forest. She has also provided intensive documentation coordination for various incident teams.

**Alan D. Hall - Desktop Publishing Specialist.** Alan holds a B.S. in Computer Science and Information Systems from the University of North Carolina at Asheville. He is currently a computer specialist for the Southeastern Forest Experiment Station and has taught classes in desktop publishing at various Forest Service offices around the country.

**Mauragrace Healey - Writer/Editor.** Mauragrace has worked with the Forest Service since 1980 in a variety of positions in public affairs, silviculture, and timber. Her specialties include Pacific Northwest Strategy, community relations, document preparation and design, and foreign languages. She holds a B.S. in Film and Television Production and has completed graduate work in writing and environmental education.

**Shirley Martin - Office Assistant.** Shirley specializes in administrative systems and procedures and has worked on various Forests in the Pacific Northwest Region for the last 16 years. She is currently the Support Services Supervisor/Budget Coordinator on the Bear Springs Ranger District of the Mt. Hood National Forest. Shirley recently completed her B.S. in Political Science/Public Agency Administration at Eastern Oregon State College.

**Victor L. White - Office Assistant.** Vic has a B.S. in General Science from Oregon State University and in recent years has specialized in support services for the production of various environmental impact statements including the Vegetation Management and Nursery Environmental Impact Statements.

## **Scientific and Peer Review**

**Robin Bown - Fish and Wildlife Biologist.** Robin has a B.S. in Wildlife Biology, a B.A. in Botany, and an M.S. in Wildlife Biology, all from the University of Montana. She currently works for U.S. Fish and Wildlife Service, Portland Field Office, as a Fish and Wildlife Biologist. Robin specializes in coordinating activities under the Endangered Species Act which relate to spotted owls in Oregon.

**Eric Forsman - Research Wildlife Biologist.** Eric has a B.S., M.S. and Ph.D. in Wildlife Management from Oregon State University. He was a member of the Interagency Scientific Committee and has participated in most of the deliberations of the various committees that have address the spotted owl issue in Oregon. He worked as an independent wildlife consultant for 7 years before joining the Forest Service 4 years ago as a Research Wildlife Biologist. Eric has conducted research on spotted owls for nearly 20 years and has published approximately 20 papers, mostly dealing with the biology and management of the northern spotted owl and other owl species. He received a publication award for monographs from The Wildlife Society in 1984.

**Grant A. Gunderson - Threatened and Endangered Species Coordinator.** Grant was also a member of the Interagency Scientific Committee. He holds a B.S. in Conservation/Wildlife Management from California State University, San Jose. During his 18 years with the Federal Government he has worked as a Wildlife Biologist for the Pacific Northwest Regional Office, Mt. Hood National Forest, and the Snow Mountain Ranger District of the Ochoco National Forest. Positions with other agencies include Area Wildlife Biologist for the Bureau of Land Management and Field Wildlife Biologist for the U.S. Fish and Wildlife Service.

## *List of Preparers*

**Richard Holthausen - Wildlife Ecologist.** Richard has spent the last 11 years with the Forest Service. He has a B.S. in Ecology from Cornell University and an M.S. in Ecology from Utah State University. Richard worked as a forest planner on the Bighorn National Forest, and as a wildlife ecologist in the Wildlife and Fish Ecology Unit at Fort Collins and with the Fish and Wildlife Unit of the Pacific Northwest Regional Office. He is currently working with the Spotted Owl Recovery Team. At the completion of that assignment, he will be stationed at Logan, Utah as the National Fish and Wildlife Habitat Relationships Program Coordinator.

**Joe Lint - Wildlife Biologist.** Joe also served on the Interagency Scientific Committee. During his 17 years with the Bureau of Land Management Joe has held various positions including Wildlife Biologist for the Oregon State Office; District Wildlife Biologist for the Roseburg District; and Resource Area and District Biologist in Coeur d'Alene, Idaho. Joe has a B.S. from West Virginia University in Forest Management and an M.S. in Wildlife Management from Virginia Tech.

**E. Charles Meslow - Cooperative Unit Leader.** Charles served on the Interagency Scientific Committee. He has both a B.S. in Fish and Wildlife Management and a Ph.D. in Wildlife Ecology/Zoology from the University of Wisconsin. He is currently with the U.S. Fish and Wildlife Service as the leader of the Oregon Cooperation Wildlife Research Unit and is also a Professor of Wildlife Ecology at Oregon State University. Charles has published numerous papers on spotted owls and other forest wildlife and habitat relationships.

**Barry R. Noon - Project Leader.** Barry served on the Interagency Scientific Committee. He has a B.A. from the University of Vermont and a Ph.D. in Biology from the State University of New York. He has worked for the Forest Service for the past 4 years and is currently the Project Leader for the Redwood Sciences Lab in Arcata, California. Prior to joining the Forest Service, Barry taught at the State University of New York, Siena College in New York, and Humboldt State University. He also worked in research at the State University of New York and with the Fish and Wildlife Service at the Patuxent Wildlife Research Center. Barry has received numerous awards and has published 40 papers, primarily in avian ecology, population and community ecology, and biometrics.

**Jack Ward Thomas - Project Leader.** Jack served as the Chairman for the Interagency Scientific Committee and has over 21 years experience with the Forest Service. His positions have included: Project Leader and Chief Research Biologist, Pacific Northwest Research Station, La Grande, Oregon; Research Wildlife Biologist, Urban Forestry Research, Amherst, Massachusetts; Research Wildlife Biologist, Morgantown, West Virginia; and Wildlife Biologist, Texas Parks and Wildlife Department. His education includes a B.S. from Texas A&M University in Wildlife Management; an M.S. from Virginia University in Wildlife Ecology; and a Ph.D. from the University of Massachusetts in Forestry. Jack holds several adjunct professor positions; has about 250 publications primarily in biology of a species, wildlife habitat and land-use planning; and has received numerous publication, conservation, recognition and distinguished service awards. He has also had assignments to help develop wildlife programs in Pakistan and India.

**Specialist Support**

Frank Burch  
Hilton Cass  
Dick Creed  
Larry Cronenwett  
Douglas K. Daoust  
Greg Denitto  
Karl Dennison  
Mike Diggles  
Robert Fujimoto  
Mel Greenup

Don Goheen  
Tom Henry  
Sue Husari  
Jon Kennedy  
Gary Laughler  
Bob Lewis  
Dave Marlow  
Jamia Murray  
John Nesbitt

Mike Nitsch  
Gary Plisco  
Roger Sandquist  
Michael Skinner  
Mike Srago  
Sandy Stone  
David F. Thomas  
Christine Walsh  
Bud Usher

**Biological Support**

Ralph G. Anderson  
Stuart M. Croghan  
Don DeLorenzo  
Cheryl Ann Friesen

Mike Gerdes  
Sarah Madsen  
Joe Moreau  
Sonny Paz

Phyllis Reed  
JoEllen Richards  
David M. Solis  
Lee O. Webb

**Editing and Publishing**

Sandy Abercrombie  
Kathy Bowman  
Anita Brown  
Wally Deschene  
Nancy Donaldson

Katherine Farrell  
LaWanda Forsythe  
Maria Gregory  
Erik Holst  
Cindy Lindh

Joanne McRae  
Jeff Wheeler  
Gwen White  
Carolyn Wilson

**Analysis**

Alan Ager  
Arlene Angelides  
Laura Chapman  
Bill Connelly  
Sara Crim  
Candace Dillingham  
Tamara Easter  
Peter Eldred

Rob Evans  
Kendrick Greer  
Rich Hagestadt  
Jerry Haugen  
Jim Hays  
Ward Hoffman  
Joel King  
Bob Lewis

Jim Merzenich  
John Nunan  
Shannon O'Brien  
Vladimir Steblina  
Andy Taylor  
Frank Vella

**Computer and Communications Systems**

Norene Blair  
Paige Burns  
Lee Campbell

Ron Galdabini  
Holly Martin  
Harry Richter

Barry Webb

*List of Preparers*

**Geographic Information Systems, Mapping and Data Base Development**

Patti Aberg	Rick Hardy	Dennis Patterson
Ken Adee	David Hatfield	Andy Peavey
Bea Anderson	Mark Hirschberger	Jean Postlethwaite
Kathy Armstrong	Camille Horn	Bill Powers
Cathy Askren	Debbie Horn	Charlie Phillips
Don Boucher	Michelle Howerton	Karen Raferty
Brad Burmark	Rob Huff	Julie Ranieri
Ken Byford	Ron Jackson	Doug Rawson
Laura Chapman	Paula James	Ed Reilly
Tim Charnon	Glenn Johnson	Elaine Rybak
Greg Clevenger	Rick Jordan	JoEllen Richards
Rosanna Costello	Susan Kimble	Linda Saunders-Ogg
Fred Craig	Patricia Ko	Ray Scharpf
Vern Creasap	Don Kudrna	Jack Schlotter
Kathy Cromwell-Christian	Aimee LeSieutre	Ann Sprague
John Dabritz	Dan Little	Theresa Stone
Barbara Daniels	Irene Locke	Sherry Summerfield
Kelvin Davis	Nicole Luce	Andy Taylor
Javier Delgado	Mike Lund	Debra Tatman
Roger Evenson	Dave Lysne	Rick Toupin
Ted Falkner	Jim Mayo	John Townsley
Fran Faure	Jan McCormick	Carol Tyson
Bill Fodge	Pat McNeil	Theresa Valentine
Jan Fox	Joanne McRae	Charlie Vandemoer
Bill Gaines	Ernie Meisenheimer	Richard Van Dewater
Robert Garcia	Elizabeth Milliman	Hung Vo
David Glose	Kathy Milne	Cal Wettstein
Randy Gray	Carol Murdock	Andy Wilson
Norm Grenell	Heather Murphy	Annie Wilson
Rick Griffin	Patrick Murphy	Shirley Woodriff
Ed Hall	Bob Naney	Dave Zalunardo
John E. Hall	Dorothy Parmelee	Ray Zalunardo

**Document Reviewers**

Joyce Andersen	Kent Mays	Rich Reeves
Mark Delfs	Phil Mattson	Mike Skinner
Mike Gertsch	Joan G. McAndrew	Susan Yonts-Shepard
Kathy Johnson	Tom Ortman	

**Maps/Graphics**

Vi Agnew  
Deb Albright  
Mark E. Flannery  
Susan Golden

Martina Gonzales  
David Lang  
Leah Pyles  
Gail Saunders-Boyle

Laurie Ystad  
Cheri Ziebart

**Public Comment Analysis**

Laura Jo Erickson  
Susan Cone

Janet Hada  
Arnold James

Lana Thurston  
Suzanne Wiley



---

## Distribution List



# Distribution List

---

The mailing list for this Final Environmental Impact Statement was developed from all requests received after the publication of the Draft Environmental Impact Statement. Each person and organization who submitted written comment during the comment period was also included on the mailing list.

The distribution list below represents all those individuals and organizations who requested and were sent full copies of the Final Environmental Impact Statement. An additional 6,826 individuals and organizations received a copy of the separately bound Summary.

## Elected Officials and Federal Agencies

Honorable Slade Gorton	Department of Transportation
Honorable Brock Adams	Dept of Health And Human Services
Honorable John Miller	Dept of Housing & Urban Development
Honorable Al Swift	Deputy Asst. Secretary of Air Force
Honorable Norm Dicks	Deputy Asst. Secretary of Defense
Honorable Jim Mcdermott	Director, U.S. Dept. of Interior
Honorable Rod Chandler	Environmental Protection Agency
Honorable Bob Packwood	EPA Federal Agency Liaison Division
Honorable Les Aucoin	EPA, Environmental Education Branch
Honorable Mark Hatfield	Federal Aviation Administration
Honorable Mike Kopetski	Federal Highway Administration
Honorable Robert Smith	General Services Administration
Honorable Slade Gorton	Interstate Commerce Commission
Honorable Jolene Unoeld	National Marine Fisheries Service
Honorable Sid Morrison	National Park Service
Honorable Norm Dicks	North Cascades National Park
Honorable Peter Defazio	Northwest Power Planning Council
Honorable Thomas Foley	Office of Arch. And Environ. Protec
Honorable George Miller	Office of Equal Opportunity
Honorable Kevin Lynch	U. S. Department of Energy
Honorable Wally Herger	Oregon Caves National Park
Honorable Alan Cranston	Rural Electrification Admin.
Honorable John Seymour	Soil Conservation Service
Honorable Frank Riggs	U.S. Army Corps of Engineers
APHIS, BBFP, EAD	U.S. Army Engineering & Housing
Bureau of Land Management	U.S. Coast Guard
Chief of Navy Operations	U.S. Fish & Wildlife Service
Crater Lake National Park	U.S. Tennessee Valley Authority
Department of Commerce, NOAA	U.S. Fish & Wildlife Service
Department of Energy, BPA	USDA, Soil Conservation Service

## **State Agencies and Elected Officials**

Honorable Robert Pickard  
Governor Barbara Roberts  
Governor Booth Gardner  
Honorable Bill Bradbury  
Honorable Walt Schroeder  
Honorable Dan Hauser  
Honorable Douglas Bosco  
Governor Pete Wilson  
Honorable Robert F. Smith  
Honorable Cedric Hayden  
Ca. Dept. of Fish & Wildlife  
Calif. Clearinghouse  
Calif.Dept.Forest & Fire Protection

FHWA—Oregon Division  
Oregon Department of Transportation  
Oregon Department of Forestry  
Oregon Department of Geology And  
Oregon State Highway Division  
Oregon State Highway Division  
Oregon State Parks And Recreation  
State Lands Commission  
The Resources Agency of California  
Washington Department of Wildlife  
Washington Department of Transportation  
Washington Govenors Timber Team  
Washington Legislative Committee On Trade

## **County, City, Local Governments And Elected Officials, And Schools**

Josephine County Planning  
Assoc. of Oregon Counties  
Board of Supervisors, Shasta Cnty.  
City of Klamath Falls  
City of Maupin  
City of Philomath  
City of Weed  
Clackamas County Forest Program  
Clallam Cnty. Econ. Dev. Council  
Clallam County  
Coos County Commissioner  
County Administration Office  
County of Siskiyou  
Douglas County Commissioner  
Hood River County Planning Dept.  
Josephine County Forestry  
Josephine County Oregon Courthouse  
Josephine Cyt. Legal Council

Klamath County Board of Comm.  
Lake County Planning Department  
Lassen Co Brd of Supervisors  
Linn County Commissioner  
Marion County Commissioner  
Mid-Willamette Valley Council  
Modoc Co Board of Supervisors  
Multnomah County Planning Division  
Plumas Co Board of Supervisors  
Polk County Commissioner  
Seattle Water Department  
Siskiyou County  
Skamania County Commissioner  
Sweet Home School District  
Tacoma Public Utilities  
Trinity County Board of Supervisors  
Umpqua Regional Council of Govts.

# American Indian Organizations

Clatsop-Tillamook Intergrt. Council  
 Kokomish Tribe  
 Northwest Indian Fisheries Comm.

The Confederated Tribes  
 Tulalip Fisheries  
 Yakima Indian Nation

## Businesses

Alice's Restaurant  
 Avision Lumber Co.  
 Avison Lumber Company  
 Beak Consultants, Inc.  
 Bohemia Mine Owners Association  
 Boise Cascade Corporation  
 Burney Forest Products  
 Calpine Corporation  
 Cascade Logging Inc.  
 Champion Intl. Corp.  
 Coast Range Association  
 Cogan, Sharpe & Cogan  
 Collins Pine Company  
 Columbia Plywood Corporation  
 Commencement Underwriters  
 Crystal Mountain Resort  
 Davis Wright Tremaine  
 Delson Lumber  
 Donahue Distributing  
 Douglas County Forest Products  
 Drabkin And Tankersley  
 Early Winters Resort  
 Emmett Baugh Co. Inc., Trucking  
 Erickson Air-Crane Co.  
 Eugene F. Burrill Lumber Co.  
 Fort Vancouver Plywood  
 Fruit Growers Supply Company  
 Georgia Pacific  
 Hanel Lumber Co., Inc.  
 Harza Northwest, Inc.  
 HDR Engineering, Inc.  
 Headwaters  
 Hi-Ridge Lumber Company  
 Hoh River Timber, Inc.  
 Imt Agencies, Inc.  
 International Paper Co.  
 Jensen Securities  
 Kogap Manufacturing Company  
 Kysar Tree Farm Management  
 Lance Forest Products  
 Log Truckers Conference Of Washington

Louisiana-Pacific Corporation  
 M. Savala Construction, Inc.  
 Mason, Bruce & Girard, Inc.  
 Mater Engineering  
 Medco  
 Mt. Hood Medows  
 Musselman and Assoc., Inc.  
 Natural Resources Mgmt. Corp.  
 North Coast Farm Credit  
 Oregon Intl. Port of Coos Bay  
 Oregon Raptor Center  
 Pacific Gas and Electric Company  
 Pan Ocean Shipping Company  
 Ply-Trim, Inc.  
 Portland Water Bureau  
 Powell, Goss & Associates  
 Rose Logging  
 SDS Lumber Company  
 Second Growth, Inc.  
 Seneca Sawmill Company  
 Sierra Pacific Fund  
 Sierra Pacific Industries  
 Southern Pacific  
 Spalding & Son, Inc.  
 Starfire Lumber Company  
 Stevenson Co-Ply, Inc.  
 Stokes Construction Co., Inc.  
 Stone Forest Industries Inc.  
 Sun Studs, Inc.  
 The Arthur Farm  
 The Campbell Group  
 The Consultant Group  
 The Planning Center  
 The Seamless Web  
 Unocal Geothermal Division  
 W.M. Beaty and Assoc.  
 Western Forest Industries  
 Western Wood Preservers Institute  
 Weyerhaeuser Company  
 Willamette Forestry Council  
 Willamette Industries, Inc.

## Distribution List

## Interest Groups

Aerial Forest Management Foundation  
AFSEEE  
Alaska Forest Association  
Alpine Lakes Protection Society  
Alta California Alliance  
American Forestry Association  
American Motorcyclist Association  
American Rivers  
Aquatic Resource Conservation Group  
Associated Oregon Loggers  
Audubon Society of Corvallis  
Audubon Society of Portland  
Blue Ribbon Coalition, Inc.  
Bohemia Mine Owners' Association  
California Forestry Association  
California Wilderness Coalition  
California Women In Timber  
Cape Arago Audubon Society  
Cascade Geographic Society  
CGO, OLC  
Chec - Forest Watch  
Citizens For Better Forestry  
Citizens' Review  
Concerned Friends of The Winema  
Del Norte Taxpayers' League  
ECO Northwest  
EF! Stumpfrogs  
Environmental Defense Fund  
Environmental Impact Services  
Eugene Natural History  
Federation of Western Outdoor Clubs  
Forest Conservation Association  
Forest Conservation Council  
Forest Matters  
Forest Preservation Society  
Freshwater Grange #499  
Friends of Plumas Wilderness  
Friends of The Metolius  
Green World International Park Coa  
Habitat Management  
Hayford Economic Alliance  
Klamath Forest Alliance  
Klamath/Siskiyou Coalition  
L.C.E.R.  
Lane County Audubon Society  
Local Residents For Old Growth  
Magic Valley Trail Machine Assoc.  
Marbl eMountain Audubon Society  
Mazamas Conservation Committee  
Mendocino Environmental Center  
Mendocino Forest Watch

N.C. Washington Audubon Society  
National Audubon Society  
National Wildlife Federation  
Native Plant Society  
Natural Resource Defense Council  
North Cascades Conservation Council  
North Coast Environmental Ctr.  
Northcoast Environmental Center  
Northern Humboldt Pomona Grange #48  
Northwest Environmental Advocates  
Northwest Forestry Association  
Northwest Independent Forest Man.  
Northwest Mining Association  
NW Forest Resource Council  
NW Independent Forest Manufacturers  
Oregon Equestrian Trails  
Oregon Hunter's Association  
Oregon Hunter's Association  
Oregon Lands Coalition  
Oregon Natural Resources Council  
Pacific Forest Consultants  
Pilchuck Audubon Society  
Public Forestry Foundation  
Public Timber Council - NFPA  
Quilcene Ancient Forest Coalition  
Rocky Mountain Elk Foundation  
Santiam Wilderness Committee  
Shasta Alliance For Resources & Environ.  
Sierra Club Legal Defense Fund  
Sierra Club No. Ca/Nv Field Office  
Sierra Club, Redwood Chapter  
Siskiyou Audubon  
Siuslaw Soil & Water Conservation  
Siuslaw Timber Operators Assn.  
Smith River Alliance  
Society of American Foresters  
Southern Oregon Alliance For Resour.  
Southern Willamette Earth First  
The Mountaineers  
The Research Group  
The Wilderness Society  
Trout Unlimited  
Umpqua Valley Audubon Society  
Wash. Native Plant Society  
Washington Contract Loggers Assoc.  
Washington Lands Coalition  
West Valley Citizens For Timber  
Willamette Timbersmen Assoc.  
Wind River Adopt-A-Forest  
Yolo Environmental Resource Center

## Individuals

Edwin B. Abbott  
 Frank Abramonte  
 Stark Ackerman  
 Tennora Adams  
 Roger Addleman  
 Frank Anderson  
 Thomas M. Ahrns, D.C.  
 David R. Akins  
 Donna M. Alber  
 Richard H. Allan  
 Michael L. & Linda M. Allan  
 Sam Allsop  
 Mary Ann Amann  
 Jack And Donna Amar  
 Luke I. Anavi  
 Patricia J. Anderes  
 Dave Anderson  
 John Anderson  
 Mark Anderson  
 Janice Anderson  
 Gerald C. Ansell  
 Jane Arambel  
 Jeff Ard  
 Marsha F. Armstrong, M.D.  
 Prof. Susan J. Armstrong  
 Jim Arneson  
 R. J. Atkinson  
 Eric C. Atkinson  
 Margaret E. Atwood  
 Karen Austin  
 Terri Ayers  
 Frank Backus  
 Tim Bailey  
 Pete Bailey  
 Robyn M. Bain  
 Allan Baird  
 Gerald L. Baker  
 James A. Baker  
 Robert Mitchell Baker  
 E. A. Baldwin  
 Wilma Banfill  
 Patrick Banks  
 Todd Barker  
 James R. Barnes  
 Rick Barnes  
 Cliff Barnhart  
 William F. Barnum  
 Donald D. Barr  
 Frank Barron  
 James S. Basey, Sr.  
 Leo Basl  
 Jeanette Basl  
 Tiny Bates  
 Irene L. Batey  
 John Bauer  
 William Baumgartner  
 Tim Baxter  
 William F. Beamer  
 David Bean  
 Travis Bebout  
 Dr. Albert J. Beck  
 Jon A. Beck  
 Dr. Rudi Becking  
 Leroy Beehner  
 Mickey Bellman  
 Stephen Benner  
 Ole Bergman  
 Martin Bergoffen & Frank Abramonte  
 Dorothy Bernardi  
 Steven Berry  
 Richard K. Best  
 Joseph Bielawicz  
 Cecil Bilbao  
 Rosemary Bird  
 Ken Bird  
 John Bischoff  
 Patrick S. Bitz  
 Cris Blackert  
 Hilary Rae Blair  
 Nigel & Ann Blakley  
 Gary W. Blanchard  
 Tal Blankenship  
 Blanche Blankenship  
 T. C. Bloch  
 Greg Blomstrom  
 S. Bloom  
 Marshall Bloom  
 Linda Blum  
 Marion Boatwright  
 Jeffrey Jon Bode  
 Eric A. Bohm  
 Richard Bonn  
 Charles Bonny  
 Robert D. Boone  
 William R. Booth  
 Maria Boroja  
 Clifford Bove  
 Joseph Bower  
 Dr. Lee H. Bowker  
 Ellis L. Bowman  
 Wendy Boyd  
 Michael Boyd  
 Wade C. Boyd  
 Stan Bradshaw  
 Richard H. Braun  
 Jodi Braun  
 Martha Bray  
 William Brevoort  
 Dick Briggs  
 William & Lavonne Brimhall

## Distribution List

Terry L. Brooks	Richard Chaney
Arlene Brooks	Thomas J. Chaney
R. Brothers	George M. Chase
C. S., Judy, & Scott Brown	Craig L. Chase
Marcia D. Brown	Al Chase
Lisa Brown	John T. Chatt
Ms. Elizabeth Brown	Bill Chenoweth
Charles Bruce	Pastor Paul H. Chisholm
Peter Brucker	John Chmelik
Dan Brummer	Dave Cholewinski
Dennis R. Bucks	Shelly Christopher
Ross Burgess	Phillip Christy
David Clarke Burks	Karen Clark
Bill Burley	John Van Cleave
Mark B. Burnett	Eric Clough
Leroy Burns	Robert Coats
Joe Burns	Steve Cochrane
Pat Burns	Neal L. Coenen
James Burris	Wm. G. Cogan
R. S. Burton	Doris E. Cole
F. M. Busby	Michael Collins
David Butt	Chris Colson
Mary L. Byford	Mike Conaway
Rex Caffall Jr.	Jerry Cone
Bernalla Calkins	Susan Cone
Shaun Callahan	Virginia Conley
John Campbell	Kelly G. Conner
C. D. Campbell	Howard Cooke
Richard A. Campbell	Keith A. Cooley
Bruce Campbell	Anthony W. Cooley
James S. Campbell	Joyce Coonrod
Mary Campbell	Romain M. Cooper
E. A. Capizzi	Clifford L. Cooter
Ernesto Garcia	Albert S. Copeland
Yvonne Cardemil	Glen Corbett
Kenneth Carden	John Corman
Ralph Cardwell	Jennie And Bryan Cornell
Christopher Carey	Mark Cortright
Karl & Mary Carlson	Oscar R. Cox
John And Julia Carlson	John L. Coyier
Don Carlton	S. Coyier
Gerald Carr	Joe L. & Marcia Coyier
Anna Carroll	Bob Crain
Wm. A. Carstens	James Craine
Robert Cart	Jack Crawford
Ben Carter	Susan Terence
Scott Carter	Joseph M. Crenshaw
Steve Carter	Larry L. Cribbs
E.R. Casey	Robert V. Crowell
Dan Casey	David Cruzan
Andrew H. Caspar	Dr. Wynn W. Cudmore
Jennesse Cathers	Wynn W. Cudmore
Ann Cavanagh	Wanda M. Custance
John Cavers	Tricia Cutler
Michael A. Celayeta	Patrick Dadey
Edwin L. Chaffin	James E. Dalziel

Distribution List

Joseph Danko	Eleanor Dyke
Jack C. Darley	James B. Eblin
Don Darling	Francis C. Eddy
Edward Dart	Bill Edmison
Roy A. Davenport	Glen D. & Barbara A. Edwards
Daryl D. David	Lois Eggleton
Peggy Ann Davidson	Robert A. Eilefson
Mark C. Davis	Ann Eissinger
Tom H. Davis	Fred Eissler
Patrice Davison	Daniel Ekblaw
Jim Dayton	Kenneth Raymond Elbert
Larry Dean	David H. Ellingson
Darrell Debs	Maynard Ellis
William R. Dejager	Danny Ellison
James Delsman	Joseph B. Ely
Beth Delson	Duane Enck
Debby Dennison	Helge Eng
Jean Despain	Hal Engelen
Joseph S. Dieni	Edward F. Engle
Jerry Dierken	Dr. Kimball S. Erdman
David F. Dietzman	Larry Erickson
Michael F. Diggles	Myra Erwin
Stan B. Dill	Ria O. Estolas
Lynne M. Diltz	Willis A. Evans
Tom Dimitre	R. Kirk Ewart
Joan Corbett Dine	Lyle J. Fagnan
Rebecca Dirschel	Rich & Terry Fairbanks
Jake Dodson	Verne H. Farrell
Allan R. Dohmen	Jay Faulconer
Rich Donnell	Brian J. Federici
Bob Doppelt	Michael G. Feeley
Geoff Dorsey	Thomas Fend
Hank Dorst	Floyd D. Ferguson
Stephanie Dotson	James A. Ferrara
Sue Douglass	David Fierstein
M Lee Douthit	Paul Finn
Mike Dowling	R. Fischer
Ronald Downey	M. J. Fitzgerald
Mark W. Downie	Norman E. Flock
Thomas Downing	D.F. Flora
George Draffan	Kathryn V. Foley
Mr. Stacy A. Drury	Barbara Fontaine
Bill Dryden	Mary C. Forst
Julie Du Bois	Margaret G. Forsythe
Mrs. D.B. Dubois	Susan A. Foster
Ed Ducot	Robert A. Foster
Jerry Duffy	Greg Foster
Glen S. Duncan	Susan Fowler
Ed Dunkley	Alan Franklin
Gloria Dunn	Gary Fredricks
George Duran	Fred Frei
George Duran	Liz Frenkel
D. Durant	Clark Frentzen
Polly Dyer	Rob Freres
Polly Dyer, Director	Paul Friesema
Eleanor Dyke	Jacqueline Frizenschaf

### *Distribution List*

Jack G. Frost  
Charlie Frye  
David Fuller  
Chris Fulton  
Roger Funk  
Stephen L. Funk  
John M. Gaffin  
Margie Gage  
Alan Gahlsdorf  
Leland Galbee  
Maradee K. Gale  
Kenneth Galloway, Jr.  
Glen Gantz  
Jessica Gonzales  
Susan Garber  
Melissa Gardner  
Len Gardner  
Roger C. Garrett  
Pfc Michael J. Garske  
Frank Gearhart  
Melissa Gentry  
Scott George  
Bob Gerl  
William German  
Leo P. Gibson  
Michael B. Gillett  
Lawerence Givens  
Brent & Margie Gleaves  
David Glen  
Rolf D. Glerum  
Ken Goldsmith  
Jerry Gonzales  
Terri Gonzalez  
Bob Goodfellow  
Lee Goodman  
C. L. Goodson  
Jerry L. Goodwin  
William Goodwin  
Hal Goodyear  
Richard J. Gordon  
Edward Gorge  
John Gorman  
Boe Anna Gorsuch-Martin  
Rose D. Goss  
Norm & Eve Gould  
Lisa & Jim Gourley  
Samuel M. Graham Jr.  
Bonnie Graham  
Miss Elsie Grapentin  
Walter L. Gray  
Michael D. Gregory  
James P. Gries  
James Russell Griffin  
Jean Grimm  
Steve Griswold  
Barbara J. Griswold  
Steve Gromacki  
Clyde L. Groshong  
Robert Groves  
Marvin Grunberg  
James P. Gubetta  
Don Gum  
D. Gumtow-Farrior  
Gary Gundlach  
Jeanne Gurule  
Gary Guttormsen  
Darrel Gutzler  
Jeff Guy  
Janet Hada  
Perry Hagenstein  
Stephen W. Hager  
Richard Hahn  
Steve Hale  
Thomas I. Haley  
Frank Hall  
Kathy Halloway  
James A. Hallstrom  
Emberson Hamilton  
Gary Hamlet  
Mike Hamm  
Rob Handy  
Bill Hanel  
Skip Hansen  
Ted Hansen  
Dan Hanson  
Gerald Haram  
John S. Harbison  
Merle P. Hargis  
Jim Harper  
Peter Harrell  
Timothy B. Harrington  
Bethel And Albert Harris  
E. P. Harshman  
Mary Jo Harvie  
Fred B. Hauck  
Stevan H. Hauck  
David Haueter  
Scott Haviland  
Steve Hay  
Frank J. Hayden  
Phillip Hays  
Stanley Hays  
David A. Hecker  
Doug Heiken  
Donald J. Helser  
Fred A. Hendrix  
Roger D. Henslee  
Ralph Henson  
H. Jane Herbst  
Oscar G. Hernandez  
S. S. Herr  
Bill And Vee Herr

Kurt P. Herzog  
Chris Hescock  
Hubert Hettwer  
Chris Hiatt  
Barbara Hickman  
David Hill  
Muriel W. Hilliard  
William P. Hillis  
Leaf Hillman  
Joseph Hington  
Juan Hinojos  
D. Hirsch  
Hiro Nishimura  
Jack, Tyler, & Elizabeth Hoaglen  
Virgil & Barbara Hodges  
Susan Hodges  
Kurt Hoffman  
Ken Hoffman  
Hubert E. Hollenbeck  
Lee Hollinshead  
Michael Hollister  
Frank M. Hollyman  
Ed Hoover  
Donald Hopkins  
James Hopper  
Scott Horngren  
Robert K. Horton  
Carl Hosticka  
Freeman House  
Steve Howard  
Ivan C. Hoyer  
Charles Huffman  
Sarah J. Hugdahl  
Robert Hughes  
Steve Hulbert  
John E. Hummel  
Lon Humphrey  
Wm. J. Humphreys, Jr.  
Leo J. Hund  
Dave Hunter  
Noland Huntington  
Sanford Hurlocker  
John Hutchinson  
Emily Hwaung  
Joe Steere  
James Ince  
Larry L. Irwin  
Frank B. Isaacs  
Sam Jackson  
Norm Jacob  
Lynn Jacobs  
Gordon Jacobson  
Mr. James  
Arnold James  
Jim James  
Brad Jarvis

Joseph Jauquet  
Virginia H. Jeavons  
Carol Jeffers  
David Jensen  
Mari N. Jensen  
Peter J. Jensen  
Jim D. Jeppson  
Raymond L. Jerland  
Roberta John  
Barry W. Johnson  
Fred L. Johnston  
Becky Johnstone  
Howard W. Johnstone  
Steve Jolley  
Jaylen Jones  
Stuart H. Jones  
Michael Jones  
James K. Jones  
Dave Jones  
Roger Jozwiak  
Robert Jump  
Medha Kochhar  
Gary Kahn  
John J. Kaib M.D.  
James R. Karr  
Nelson Kass  
Dean Kaufman  
Joshua R. Kaufman  
Jack Kay  
Gene Keane  
Foster F. Keene  
Bill Keil  
R. K. Kelly  
E. Kelsey  
Philip C. Kelty  
Allyson E. Kemp  
Grace H. Kensley  
Cathryn L. Kent  
Melvin W. Kenworthy  
Andy Kerr  
Bruce Kessler  
Vern & Pearl Ketz  
J. Phillip Keyser  
David Keyt  
Tom King  
Edward D. King  
Anne Kinnaman  
J. Daniel Kinney Jr.  
Milton C. Kintzley  
Mr. Carey G. Kinyon  
Marshall F. Kirby  
N. J. Kirkmire  
E. J. Kirkpatrick  
Lewis L. Klein  
Glenn Klinger  
Larry Knauer

### *Distribution List*

Patrick Knight  
June Knight  
Harold Knudsen  
Ray Koon  
Carol Krasel  
Lloyd Krause  
Kevin Krefft  
Susanne Krieg  
David Krueger  
Patricia Krueger  
Walter Kuhlmann  
Ronald J. Kurtz  
Calvin C. Kuschel  
William M. Kynsi  
Mary Lammert  
Lloyd H. Larson  
Dale Latimer  
Thomas W. Lavagnino  
Tom Lawler  
Mark Lawler  
Ron Leach  
Vernon Lebeau  
Cherie S. Leclair  
Thomas C. Lee  
John Lee  
R. E. Lemmer  
Louis A. Lepry, Jr.  
Elinor A. Levin  
Paul E. Libby  
Rod Lindholm  
Tom Lindley  
David A. Linsdell  
Malcolm Lionel  
Peter List  
Ernest T. Livingstone  
Ted W. Lloyd  
P. R. Loe  
Donald E. Long  
John Long  
Kenneth R. Long  
Geoffrey M. Long  
Frank Losekoat  
Patricia Loveland  
Nena Lovering  
Wayne Ludeman  
Dale Luhman  
Deborah Lukas  
Jon Lund  
George E. Lydick  
Dale D. Lysne  
Peter Mack  
Fran Mackey  
Jim & Jill Mackie  
Britt Madison  
Jeff Madsen  
Larry C. Maechler  
Mr. David R. Magin III  
Robert A. Magne  
Thomas H. Makey  
Thomas H. & Janet D. Mallery  
Marens Maltby  
Ron Mangis  
Cliff Mann  
Clarine Manning  
Janette Mar  
Vaughan D. Marable  
Alex March  
Cliff Markhart  
Bill Marlett  
Keith Marlowe  
Norm Marsh  
James Marsh  
Charles A. Marshall  
Neil Martin  
Dr. Robert Martin  
Barry Martin  
Jesse Martinez  
Tom Martinson  
Larry Mason  
Tad Mason  
Larry Mason  
Dorothy J. Mathews  
John R. Maticich  
Paul B. Matney  
Dr. Kathleen Matthews  
John Mazur  
Elaine McAndrews  
R.M. Mccollum  
Jim Mccomb  
Scott Mccoughin  
A. M. Mccoy  
Ms. Patricia Mccrae  
Lucille F. Mcdonald  
Kristen Mcdonald  
Gregory P. Mcfarlane  
Marler Mcginnis  
Kevin Mcgraw  
Michael G. McGreevy  
Mark R. Mckelvie  
Richard L. Mckinnon  
Melvin Mcleod  
Mike Mcmahon  
David Mcmechan  
Rocky Mcvay  
Harry W. Mcwhorter  
Dahinda Meda  
Greg Melanson  
Richard Mendenhall  
Steven Merfeld  
Richard Messenger  
S. Mark Meyers  
Bill Micsan

Darryl Middleton  
Frank Mileham  
Patrick D. Miles  
Steve Millard  
Earl A. Miller  
George W. Miller  
Robert G. Miller  
Ivan Miller  
Mark Miller  
Roy L. Miller  
William E. Miller  
Cory C. Miller  
Ronald E. Mink  
Richard L. Minkler  
L. A. Minor, Phd, Md  
Les & Sue Minton  
Richard Mishaga  
Bill Mitchell  
Victor D. Modeen  
Ralph R. Modine  
Alden Moffett  
Dusty Moller  
Harry P. & Eula Monroe  
Blair Moody  
Rich & Pamela Moon  
Brent A. Moore  
Rosalie More  
David Mcmecham & Tonia Moro  
David L. Morris  
Don Morris  
Peter Morrison  
Peter Moss  
R.C. Mountjoy  
Brad Mowreader  
Mr. And Mrs. Steve Mueller  
Deanna Mueller-Crispin  
Rollie W. Mulkey  
Quinn J. Murk  
Mrs. W.L. Murray  
Kitt Murrison  
L. Naapi  
Dave Naslund  
Richard Nawa  
Clamore Needham  
Robert R. Neilsen  
Daniel A. Nelson  
Steve Ness  
Eric J. Neville  
Trent Newcomb  
John Newkirk  
Michael Newton, Professor  
Steven A. Nicholson  
Tom Nickerson  
Michael D. Njelson  
Jennifer Niemeyer  
Edward L. Nilsen  
Tom Nogler  
Paul Nolet  
Mrs. Clara Norton  
G. R. Norton  
James D. Noteboom  
Jerry W. O'Brien  
Tharon O'Dell  
Robert O'Neill  
Patrick J. O'Neill  
Mark Oberle  
Jill Oertley  
Linda Ohlhausen  
Kenoli Oleari  
Jeffrey T. Olsen  
Kim E. Olson  
Ken Olson  
Carol Orth  
Rowland M. Orum  
Christopher Orsinger  
Jim Ostrowski  
Richard Ourada  
Carl M. Owen  
Berniece Owen  
Amy Paetsch  
Chris Palmquest  
Paul Porch  
Donald, Linda & Seth Parks  
Thomas L. Parsons  
Nellie D. Patterson  
Jesse And Elaine Pattison  
Lowell E. Patton  
James M. Paul Jr.  
Warren H. Pavlat  
Val Payne  
Mike Payne  
Ray Peart  
Jack Pech  
Mary Anne Pella-Donnelly  
Norman R. Pendell  
Bob Pendleton  
Bruce Perkins  
Ron Perrow  
John L. Perry  
Ms. Linda Person  
William W. Peterson  
Jim Peterson  
Reuel G. Phillips, Jr.  
Carla L. Phillips  
Bonnie Phillips-Howard  
Larry G. Pierce  
Richard Pierson  
David Pilz  
Dennis Pobst  
William J. Poitras  
Roscoe A. Poland  
Danne W. Polk

### *Distribution List*

Kenneth C. Poniehtera	Mike Ronjoin, Jr.
Garner L. Pool	David Rood
Richard R. Pooley	Paul Rood
Dennis Pope	Don Rooper
Philip Porush	Tina Rosa
Dick Posekany	Kevin D. Rose
Steve & Julie Potwin	T. A. Rose
Dennis L. Pournelle	Charles E. Rose
Charles Powell	John Roshek
Bob Powne	Susan M. Rovito
Rick Prairie	Joseph Rovito
Stephanie Preuitt	Blake Rowe
Dr. Thomas Pringle	T. W. Rowlett
Scott E. Pringle	Jonathan Rubin
Earl Pryor	David Rubin
Louise Questad	Dave Rumker
Robert G. Quick	Barbara Rupers
Beverly Quiring	Carol Rushmore
Donald P. Raab	Richard J. Ryan
Jack Radabaugh	Lynn Ryan
Jack S. Radabaugh	Ali Sacash
Stephen P. Rae	William D. Sagaser
Karen Raftery	William A. Saily
Charles Raines	Arline St. Kopplin
Vittz-James Ramsdell	Kenneth Sanchez
Dr. Timothy Ramsey	Robert E. Sander
Julie Ranieri	Ralph Saperstein
Mark Rasmussen	Susan Saul
Gary Rayer	Susan M. Saul
Fran Recht	Fred Sawyer
Theodore W. Regier	Daniel A. Schack
David E. Reich	Julie Schaefers
Dennis Reid	Paul G. Schaufler
Cristy Rein-Ziglinski	Frank L. Scheberle
A. Troy Reinhart	Frank Schenck
Rellim Redwood Company	Chas A. Schiedler
Julia Reynolds	Curt Schneider
R. E. Rheinberger	S. G. Scholey
Wayne And Linda Rice	Mildred Levore Schoor
Michael L. Rice	Joseph Schott
Leverett G. Richards	Greg Schroer
Karen Richardson	Daniel Schultz
Larry & Linda Richardson	Nathan Schumaker
Shawn Riley	Matthew Schumaker
James Ringelberg	Shirley Schwartz
Fred L. Rinne	Carl H. Schwarzenberg
Jennifer Rivais	R. G. Scrafford
Norman Rivieie	Billy M. Scruggs
Matthew Robinson	Michael Scuderi
John C. Robinson	Kenneth Seago
Ellen Rodriguez	Jerome Sedlak
Ken Roelofs	Curtis Seide
Hazel-Louise Rogers	C. W. Selden, III
Clark Rogerson	Charles W. Selden, III
David N. Rolph	Steven Self
Wally Roney	Steven Self

*Distribution List*

Steve Self  
Helen Senz  
D. Shaheed  
Gwynne Sharrer  
G. H. Sharrer  
Roy W. Shay  
Earnest H. Shearer  
Jon Sheldahl  
Jon Shemperiak  
Mary Sherier  
Dennis Sherwood  
James Sherwood  
Marsha Shewczyk  
Michael W. Shippey  
Bruce Shutvet  
Linda Simmons  
Keith Simmons  
Daniel Simpson  
Wes Sine  
Luther F. Skeels  
Leon Skiles  
Daniel W. Slater  
Louis Slegel  
Bonnie And Harold Sloan  
Arthur E. Slover  
Jerald E. Smallidge  
Mr. & Mrs. Earl Smiley  
Howard Smith  
Fred Smith  
Edward M. Smith  
Kelly L. Smith  
Dr. Sandra Smith  
Joan T. Smith  
Roger F. Smith  
Eric Smith  
Kathy Smith  
Stephen A. Smith  
Kay Smith  
Doug Snyder  
Daniel Southard  
Daniel L. Souza  
Steven M. Speich  
Patrick K. Spence  
Terri S. Spencer  
Marilyn Stamps  
Julie Stangell  
Christopher Stearns  
Mary Lee Steffensen  
Eril Steger  
Cheryl Steinbring  
Lynda K. Steiner  
W. Rex Stevens  
Joanne Stevens  
L. L. Stewart  
Walter Stipe  
Dale Stirling

Robert Stockdall  
Jim Stoffer, Photographer  
B. Stone  
Daniel J. Stotter  
Richard Stoutenburgh  
Kim R. Stowe  
Rick Stratton  
Rick Stringfield  
Janet A. Strong  
Mr. Gilbert A. Stuart-Forester  
Thomas E. Stumpf  
Linda Moon Stumpff  
Richard S. Sund  
Howard Sunkler  
Ron And Denise Sutphin  
Spring Star Svart  
Tom Swanson  
John R. Swanson  
Joy Swanson  
Susan Swecker  
Paula Swedeen  
Debby Sweeten  
Mark Swift  
Norm Swords  
Dr. Laszlo J. Szijj  
Jeffrey Szmania  
Jerry Tangren  
Jack Jay Tannehill  
Michael D. Taxay  
Dr. Roger J. Taylor  
Scott Taylor  
James L. Tellier  
Sanford Tepfer  
Lynn & Michael Thamer  
Dennis M. Thibeault  
John H. Thomas  
John Thomas, Jr.  
Erik Thompson  
Dale Thornburgh  
James Danny Thornton  
Dale Thornton  
Robert W. Thorson  
Lana Thurston  
Gina Tilton  
James L. Tinnin  
Jim Todd  
Wesley Toevs  
Chris Topik  
Russell Totman  
Sara Tower  
John Townsley  
Paula D. Tripodi  
Guntis Turks  
Dick Turner  
William A. Tweedie  
Pam Udd

## Distribution List

Sherry Ulin	John White
Andrew Van Atta	Lornie White
Charles P. Van Epps	Clifford L. Whitehouse
Randall Van Prooyen	Robert Wick
Dick Vandemark	Karen Wilk
Lucille Vinyard	Dwight Willard
Phillip Vollman	Bruce Willett
Stephen Vorhes	Robert F. Willey
Dennis P. Vroman	Bill Williams
William S. Waddel	Dave Williams
Wally D. Wagner	Kathy Williams
Fred Wahl	George Williams
Harold E. Wald	Howard L. Williams
Anne Walent	Howard Williams
Diana Wales	Mike Williams
Matthew Walker	Douglas Willis
Ketti Walker	Harry E. Wilson
Robert Walls	Raymond C. Wilson
James Walthers	Ruth Wilson
Glen S. Walton	Terry C. Wilson
Patty Walton	Doug Wilson
Prof. John G. Ward	Karen Wilson
Keith Warner	Charles P. & Andrew K. Wines
Christopher Warren	Diane Wisley
Jeff Warren	Paul Wittbrodt
John W. Warren	Robert E. Wolf
Kelly M. Warren	Mr. Lindy L. Wolf
Fred J. Warren	Edward Wolf
R. F. Watson	Ken Wolf
Joe Watson	Karen Wood
Robert P. Watson	Dan Wood
Robert R. Weaver	George S. Wooding
Lee Webb	Donald E. Woodman
John P. Weber	Desiree Woolley
Jennifer Weeks	John Woolworth
Dr. Ralph E. Wehinger	Richard B. Worthey
Lee C. Weichselbaum	J. Wrabek
Carl Weidert	John A. Wray
Nancy Weintraub - Efsbg	Danny L. Wright
Saul Weisberg	Graham J. Wright
Albert Weise	Mr. & Mrs. J. Wright
Rick S. Weitman	Homer L. Yates
Nancy Wells	Ronald S. Yockin
David Werntz	Don Yon
Niels West	Steven Yost
Richard C. West	John Young
Robert B. West	Juan Yraguen
David M. West	Alec Zacaroli
Vicki Westbrook	E. Zahn
Sue Westlake	Glenn A. Zane
Peter Wetherwax	Margaret Kettunen Zegart
Jessie Wheeler	Mark Zeibak
Jeff Wheeler	Arthur Zimmer
Steven B. Wheeler	Randy Zustiak
Celeste Wheeler	Roger Zwanziger

## **Libraries**

Eastern Washington University  
Albina Branch Library  
California State University, Chico  
Carmichael Regional Library  
Coffenberry Junior High School  
Coos Bay Public Library  
Corvallis Public Library  
Dallas Public Library  
Eagle Point Library  
W of W Forest Resources Library Aq-15  
Forest Resources Library Aq-15  
FS Info NW, Aq-15  
Humboldt State University  
Josephine County Library System  
Junction City High School Library  
Klamath County Library  
Lake Oswego Public Library  
Lewis & Clark College

Library College of The Redwoods  
Midland Branch Library  
Multnomah County Library  
Nevada State Library & Archives  
Northwestern School of Law  
Oregon Institute of Technology  
Oregon State Library  
Oregon State University  
Pacific Northwest Regional Library  
Salem Public Library  
Seattle Public Library - GPS  
Sheridan Public Library  
Southern Oregon State College  
Springfield Public Library  
University of Alaska-Fairbanks  
Washington State Library  
Weyerhaeuser Company Library

## **Media**

KRCR-TV  
Cascade World  
Editor Of The Cedar Pole News  
KDRV-TV  
Land Letter  
Logger's World  
Loggers World  
Omak Chronicle  
Record Searchlight  
Sacramento Bee  
Seattle Times

Springfield News  
The Bulletin  
The Chronicle  
The News-Review  
The Oregonian  
The Register Guard  
The Stayton Mail  
The Times Standard  
Trinity Journal  
Upper Rogue Independent



---

# Index



# Index

---

50-11-40 rule - 2-32, 2-44, 2-66, 3&4-23, 3&4-79, 3&4-103-107, 3&4-116, 3&4-120, 3&4-130.

Abundance and Distribution of Northern Spotted Owls, 3&4-33.

Adaptive Management, 2-33-35, 2-54.

Adjustment Process, 2-40, 2-16, 2-33, 2-42, 2-44.

Affected Environment, 3&4-159-160, 3&4-183, 3&4-197, 3&4-203, 3&4-211, 3&4-214, 3&4-217.

Allowable Sale Quantity, 3&4-103-108, 3&4-110, 3&4-116, 3&4-119.

Alternative A Viability Rating, 3&4-94.

Alternative B Viability Rating, 3&4-96.

Alternative C Viability Rating, 3&4-97.

Alternative D Viability Rating, 3&4-98.

Alternative E Viability Rating, 3&4-99.

Alternatives Including the Proposed Action, 1-1.

Areas of Concern, 2-59, 2-75, 3&4-28-29, 3&4-31, 3&4-47-48, 3&4-61, 3&4-65-70, 3&4-79-80, 3&4-95, 3&4-97-99, 3&4-152-153.

Allowable Sale Quantity, 26-27, 2-36, 2-55, 2-66, 3&4-101-107, 3&4-109.

Assumptions, 3&4-51.

Bureau of Land Management, 18, 2-34, 2-54, 2-58, 3&4-22-23, 3&4-33, 3&4-51, 3&4-65, 3&4-73, 3&4-76, 3&4-79, 3&4-81-82, 3&4-94.

Critical Habitat, 2-3-4, 2-41-42, 3&4-68, 3&4-76, 3&4-82, 3&4-87, 3&4-105-106.

Consequences, 3&4-121.

Criteria Used to Assess Viability, 3&4-47.

Criterion 1 Potential Change, 3&4-53, 3&4-55, 3&4-57, 3&4-59, 3&4-61, 3&4-63.

Criterion 2 Distribution, 3&4-65-70.

Criterion 3 Habitat Capability, 3&4-73, 3&4-76.

Criterion 4 Dispersal, 3&4-79.

Criterion 5 Spacing, 3&4-81.

Criterion 6 Patch Size, 3&4-84.

Criterion 7 Clustering, 3&4-87.

Cumulative Impacts, 3&4-2.

Current Management of Other Lands, 3&4-22.

Current Situation and Trends, 3&4-125-126.

Defining the Ratings, 3&4-93.

Dispersal Habitat, 3&4-16.

Early-Successional Forests, 24, 2-64, 3&4-134, 3&4-134, 3&4-139-140.

Effects of the Alternatives, 3&4-164-165.

Effects of the Alternatives on Timber Production, 3&4-107-108

Environmental Consequences, 3&4-120, 3&4-123, 3&4-129, 3&4-121, 3&4-124, 3&4-129, 3&4-158-159, 3&4-161-162, 3&4-166-167, 3&4-185, 3&4-198, 3&4-203, 3&4-211, 3&4-221.

Endangered Species Act, 18, 2-1, 2-3, 2-35, 2-42, 2-54, 2-58, 3&4-22, 3&4-39, 3&4-51, 3&4-73, 3&4-94, 3&4-142, 3&4-148, 3&4-153-154.

Factors Influencing Northern Spotted Owl Populations, 3&4-36.

Factors Influencing Population Viability, 3&4-40.

Fire, 20, 23-25, 2-59, 2-63-64, 3&4-14, 3&4-19-20, 3&4-28, 3&4-101-102, 3&4-120-121, 3&4-123, 3&4-125, 3&4-133, 3&4-121-122, 3&4-124-125, 3&4-133, 3&4-138, 3&4-140, 3&4-146, 3&4-152-153, 3&4-157-158, 3&4-165-166.

Fish, 2-64, 3&4-134, 3&4-144, 3&4-146, 3&4-152-157, 3&4-214-215, 3&4-230, 3&4-152-153.

Fish and Wildlife Service, 18, 2-1, 2-3, 2-34-36, 2-41-42, 2-54-55, 2-58, 3&4-3, 3&4-22-25, 3&4-39, 3&4-51-52, 3&4-82, 3&4-94, 3&4-97, 3&4-105-106, 3&4-106, 3&4-142, 3&4-146, 3&4-148.

FORPLAN, 3&4-102-103, 3&4-103, 3&4-119.

Geographic Information Systems, 2-19.

Habitat - Connecting, 19, 2-55, 2-59, 3&4-16, 3&4-29, 3&4-31, 3&4-48, 3&4-52-53, 3&4-70, 3&4-77, 3&4-79-80, 3&4-96-97, 3&4-105-106.

Habitat - Designated Areas Managed Primarily for Spotted Owl Habitat, 21-27, 2-1, 2-4, 2-36-37, 2-44, 2-56, 2-60-66, 3&4-16, 3&4-28, 3&4-48-49, 3&4-53,

3&4-55, 3&4-57, 3&4-59, 3&4-61, 3&4-63, 3&4-65-67, 3&4-69-70, 3&4-79, 3&4-81-82, 3&4-84, 3&4-87, 3&4-89, 3&4-96-97, 3&4-104-107, 3&4-121, 3&4-105-106, 3&4-108, 3&4-118-119, 3&4-122-123, 3&4-126, 3&4-140, 3&4-147, 3&4-154-166, 3&4-196, 3&4-211-212, 3&4-214, 3&4-230. Habitat - Dispersal, 17, 19-22, 27, 2-4, 2-19-20, 2-57, 2-59, 2-61-62, 2-66, 3&4-16-17, 3&4-23, 3&4-48, 3&4-65, 3&4-70, 3&4-79-80, 3&4-95-96, 3&4-98-99, 3&4-106-107. Habitat - Forest Matrix, 2-4, 2-20, 2-36, 2-40, 2-42, 2-44, 3&4-16, 3&4-53, 3&4-74, 3&4-105-107. Habitat - Fragmentation, 19-20, 2-59-60, 3&4-29, 3&4-31, 3&4-43, 3&4-61, 3&4-73, 3&4-95. Habitat - Multi-Resource Strategy, 2-45, 2-54. Habitat - Old Growth, 3&4-11, 3&4-13-14, 3&4-19. Habitat Conservation Areas, 19-20, 2-4, 2-19-20, 2-34, 2-36, 2-40-44, 2-59, 2-74-75, 3&4-23, 3&4-67-69, 3&4-76-77, 3&4-79, 3&4-81-82, 3&4-84, 3&4-87, 3&4-89, 3&4-96, 3&4-98, 3&4-105-107, 3&4-123. Home Range, 3&4-17. IMPLAN, 3&4-183. Implementation, 2-17, 2-35, 2-40, 2-42, 2-44, 2-55. Importance of Scale in Assessing Population Distribution, 3&4-45. Income, 3&4-169-170, 3&4-183-189, 3&4-196, 3&4-217-218, 3&4-226. Incomplete or Unavailable Information, 3&4-1. Indian Tribal Lands, 3&4-23. Information Relative to All Alternatives, 3&4-53, 3&4-65, 3&4-73, 3&4-79, 3&4-81, 3&4-87. Insects and Diseases, 23, 2-63, 3&4-101-102, 3&4-105-106, 3&4-121-122, 3&4-106, 3&4-122-123, 3&4-133, 3&4-162-163, 3&4-165-166. Interdisciplinary Team, 2-1, 2-19, 2-45-46, 2-73-75, 3&4-1, 3&4-3, 3&4-218. ISC Committee, 1-2, 2-5, 2-19, 2-33, 2-39, 2-41, 2-43, 2-59-60, 2-74, 3&4-3, 3&4-16, 3&4-43, 3&4-50, 3&4-95.

ISC Report and Strategy, 18, 20, 1-2, 2-5, 2-19-20, 2-34-35, 2-39, 2-41-43, 2-58, 2-60, 2-74-75, 3&4-11-12, 3&4-16-17, 3&4-19, 3&4-23, 3&4-35, 3&4-39, 3&4-42, 3&4-48-51, 3&4-87, 3&4-94, 3&4-97, 3&4-105-107, 3&4-106-108, 3&4-119, 3&4-155-156, 3&4-219. Issues Related to Distribution of Spotted Owl Habitat and Populations, 3&4-27. Jobs, 27, 30, 2-2, 2-67, 2-70, 3&4-1, 3&4-169-170, 3&4-183-189, 3&4-196, 3&4-217-220, 3&4-222-223, 3&4-225-226, 3&4-228. Late-Successional Forests, 24, 2-64, 3&4-36, 3&4-53, 3&4-120, 3&4-126, 3&4-121, 3&4-126, 3&4-134, 3&4-136-140, 3&4-147-148. Legal Requirements for Managing Viable Populations, 3&4-39. Land and Resource Management Plans, 18, 26-27, 2-6, 2-11, 2-16-17, 2-36-37, 2-45, 2-55-56, 2-58, 2-65-66, 3&4-51, 3&4-100-103, 3&4-105-106, 3&4-126, 3&4-129, 3&4-103, 3&4-106, 3&4-126, 3&4-129, 3&4-140, 3&4-144-145, 3&4-153-158, 3&4-161-162, 3&4-230. Lands - Reserved, 3&4-53, 3&4-80, 3&4-125. Lands - Suitable, 3&4-53, 3&4-100-107, 3&4-129-130, 3&4-105-106, 3&4-108, 3&4-116, 3&4-119, 3&4-129-130. Lands - Technically Suitable, 3&4-100-101, 3&4-104-106, 3&4-109, 3&4-105-106, 3&4-110. Lands - Unsuitable, 3&4-53, 3&4-132, 3&4-132. Management of Owl Habitat on Other Ownerships, 2-75. Marbled Murrelet, 3&4-144, 3&4-146-150. Mitigation, 3&4-121. Modeling Details and Technical Constraints, 3&4-102-103. Monitoring, 2-3. National Environmental Policy Act, 2-35, 2-54. National Forest Management Act, 1-1, 2-5, 2-16, 2-73, 3&4-39. National Park Service, 18, 2-34, 2-58, 3&4-23, 3&4-73, 3&4-76, 3&4-89, 3&4-94, 3&4-125.

Nesting, Roosting, and Foraging Habitat Studies, 3&4-12.

Northern Spotted Owl - Biology, 2-16, 3&4-1, 3&4-3-4, 3&4-16, 3&4-27-29, 3&4-31, 3&4-35-37, 3&4-42, 3&4-48-49.

Northern Spotted Owl - Populations, 3&4-70, 3&4-76.

Northern Spotted Owl - Viability, 2-62, 2-, 2-62, 2-74-75, 3&4-20, 3&4-25, 3&4-27-28, 3&4-35, 3&4-37-40, 3&4-47-50, 3&4-53, 3&4-76-77, 3&4-87, 3&4-89, 3&4-94-98, 98, 3&4

Northwest Forestry Association Alternatives, 2-74.

Other Land Ownerships, 3&4-25.

Overall Viability Rating for the Alternatives, 3&4-94.

Oversight Team, 2-35.

Overview and Historic and Current Trends, 3&4-100-101, 3&4-121, 3&4-123.

Pacific Yew, 3&4-120.

Parameters Used to Assess Viability, 3&4-44.

Payments to Counties, 27-28, 30, 2-2, 2-67, 2-70.

Physiographic Provinces, 21, 2-60, 3&4-9, 3&4-28, 3&4-31, 3&4-33, 3&4-36, 3&4-45, 3&4-47, 3&4-55, 3&4-61, 3&4-63, 3&4-73, 3&4-76-77, 3&4-79, 3&4-81, 3&4-89, 3&4-100.

Population Size in Relation to Amount and Distribution of Habitat, 3&4-42.

Population Structure, 3&4-35.

Population Viability Analysis, 3&4-39.

Port-Orford-cedar Root Disease, 3&4-122, 3&4-123, 3&4-170, 3&4-203-206, 3&4-223.

Purpose and Need, 1-1.

Range of the Northern Spotted Owl, 3&4-7.

Record of Decision, 2-5-6, 2-11, 2-17, 2-35-36, 2-55.

Recreation, 25, 2-65, 3&4-163-166, 3&4-196, 3&4-214-215, 3&4-221, 3&4-225, 3&4-229.

Region 5, 1-1, 2-5, 2-11, 2-16, 2-73, 3&4-155-158.

Region 6, 1-1, 2-5-6, 2-73, 3&4-3, 3&4-126, 3&4-155-158.

Regional Guide, 3&4-104-105.

Regulations, 3&4-39.

Related Activities, 1-2.

Relationship Between Owls and Harvest Levels, 3&4-104-105.

Research Committee, 2-54.

Scientific Panel on Late-Successional Forest Ecosystems 19-20, 24, 2-59-60, 2-64, 3&4-95, 3&4-97, 3&4-116, 3&4-138-139, 3&4-149, 3&4-155-156.

Silvicultural Systems, 3&4-101-102, 3&4-105-106.

Siskiyou County Proposals, 2-73.

Social Effects, 27, 30-31, 2-67, 2-70, 3&4-107, 3&4-108, 3&4-170, 3&4-189-190, 3&4-217-226.

Spotted Owl Viability, 17, 2-57.

Standards and Guidelines, 24, 27, 2-1, 2-4, 2-6, 2-11, 2-16, 2-19-20, 2-33, 2-35-37, 2-40-46, 2-54-56, 2-64, 2-66, 2-74, 3&4-2, 3&4-42, 3&4-52-53, 3&4-66-70, 3&4-74, 3&4-79-82, 3&4-84, 3&4-87, 3&4-89, 3&4-106-107, 3&4-107, 3&4-144-145, 3&4-147, 3&4-153-159, 3&4-165-166, 3&4-171, 3&4-180, 3&4-211.

State and Private Lands, 3&4-24.

Steering Committee, 2-35.

Technical Review Team, 2-34-35, 3&4-7

Threatened and Endangered, 2-64, 3&4-24, 3&4-142, 3&4-147-148, 3&4-153-155.

Timber Management, 23, 26, 2-2, 2-63, 2-65, 2-74, 3&4-12, 3&4-22, 3&4-27, 3&4-53, 3&4-74, 3&4-79, 3&4-100-106, 3&4-121, 3&4-123, 3&4-125-127, 3&4-129-130, 3&4-133-134, 3&4-103-104, 3&4-106, 3&4-118-119, 3&4-122, 3&4-124-127, 3&4-129-130, 3&4-133-134, 3&4-229.

Timber Production, 3&4-19-20, 3&4-23, 3&4-25, 3&4-27, 3&4-36, 3&4-51-53, 3&4-66-70, 3&4-79-80, 3&4-84, 3&4-100-103, 3&4-105-107, 3&4-109, 3&4-126-127, 3&4-129-130, 3&4-132-133, 3&4-171, 3&4-214,

Viability Rating for the Alternatives, 17, 2-57.

Water Quality, 24, 2-2, 2-64, 3&4-100-103,

Wilderness, 2-75, 3&4-23, 3&4-52, 3&4-55, 3&4-57, 3&4-59, 3&4-61, 3&4-63, 3&4-70, 3&4-73, 3&4-99, 3&4-104-105, 3&4-152-153.



---

## Glossary



# Glossary

---

**40-20'-40 Rule** - From the Multi-Resource Strategy: each watershed (approx. 5,000 to 10,000 acres) should contain at least 40 percent habitat suitable for dispersal. Dispersal habitat should have 40 percent canopy cover with clearance under the canopy averaging greater than 20 feet (used in Alternative E).

**50-11-40 Rule** - From the ISC Strategy: for every quarter township, timber harvest shall be permitted only when (or if needed to attain) 50 percent of the forest landscape has a mean d.b.h. of 11 inches and a canopy closure of 40 percent. All land use allocations on forest lands (except Category 1, 2, or 3 HCAs) are used as the land base from which to calculate the 50 percent for each ownership.

**Adaptive Management** - Adaptive management is a process to improve the management of spotted owl habitat incrementally as the agencies and scientists learn from experience and new scientific findings. See Appendix R of the Interagency Scientific Committee's Conservation Strategy (ISC Report).

**Age Class** - An interval, usually 10 to 20 years, into which the age ranges of vegetation are divided for classification or use.

**Allowable Sale Quantity (ASQ)** - The quantity of timber that may be sold from the area of suitable land covered by a Forest Plan for a time period specified by the Plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity."

**Alternative** - One of several policies, plans, or projects proposed for decision making.

**Amenity** - An object, feature, quality, or experience that gives pleasure or is pleasing to the mind or senses. Amenity value is typically used in land use planning to describe those resource properties for which market values (or proxy values) are not or cannot be established.

**Anadromous Fish** - Those species of fish that mature in the sea and migrate into streams to spawn. Salmon, steelhead, and searun cutthroat trout are examples.

**Arboreal** - Living in the canopies of trees.

**Associated Species** - A species found to be numerically more abundant in a particular forest successional stage as compared to other stages (Ruggiero et al. 1991).

**Best Management Practices** - A practice or combination of practices that is determined by a state (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (Federal Register. 40(230). November 28, 1975.)

**Board Foot** - A unit of wood totalling an area equal to 1 foot by 1 foot by 1 inch.

## Glossary

**Broadcast Burn** - Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of fuel hazard or as a silvicultural treatment, or both.

**Brush Disposal** - Cleanup and disposal of slash and other hazardous fuels within the forest or project areas.

**Brood** - The offspring of a single birth or clutch of eggs or any group of young animals that are being cared for together by an adult. To incubate eggs.

**Canopy Closure** - (Also Canopy Cover) - The degree to which the crowns of trees are nearing general contact with each other, usually expressed as the percent of area that is covered by a vertical projection of the tree crowns.

**Carrying Capacity** - The maximum number of organisms that can be supported in a given area of habitat at a given time.

**Central Secure System** - The combination of Reserved and Deferred Multiple-Pair Areas and the Connecting Habitat (used in Alternative E).

**Clearcutting** - The harvesting in one cut of all trees on an area for the purpose of creating a new, even-aged stand. The area harvested may be a patch, strip, or stand large enough to be mapped or recorded as a separate class in planning for sustained yield.

**Climax** - A community of plants and animals which is relatively stable over time, and which represents the late stages of succession.

**Climax Species** - Those species that dominate a climax stand in either numbers per unit area or biomass.

**Closely Associated Species** - A species is designated as “closely associated” with a forest successional stage if the species is found to be significantly more abundant (based on statistical significance levels set in Ruggiero et al. 1991) in that forest successional stage as compared to the other successional stages, or if it is known to occur almost exclusively in that successional stage.

**Cluster** - As used in this document, a group of pairs of northern spotted owls in proximity to each other which allows for mutual interbreeding and increases successful dispersal.

**Code of Federal Regulations (CFR)** - A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government.

**Commercial Forest Land** - Forest land tentatively suitable for the production of crops of timber and that has not been withdrawn for other reasons.

**Commercial Thinning** - The thinning of a stand where the trees to be removed are large enough to sell. This thinning is accomplished by a timber sale.

**Commodity** - A transportable resource product with commercial value; all resource products that are articles of commerce.

**Congressionally Classified and Designated Areas** - Areas that require congressional enactment for their establishment, such as national Wildernesses, National Wild and Scenic Rivers, and National Recreation Areas.

**Connectivity** - A measure of the extent to which intervening habitat truly connects HCAs for juvenile spotted owls that disperse among them.

**Connecting Habitat** - A band of habitat between two Deferred or Reserved MPAs equal to twice the width of the average annual home range and managed for 30 to 50 percent nesting, roosting, and foraging habitat (used in Alternative E).

**Contiguity** - Closeness in spacing of forests of similar composition and structure.

**Cover Type** - The existing vegetation of an area.

**Critical Habitat** - Under the Endangered Species Act, Critical Habitat is defined as “the specific areas within the geographic area occupied by a species...on which are found those physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species.” In this environmental impact statement “Critical Habitat Unit” is interchangeable with “Critical Habitat” and may refer to a specific piece of Critical Habitat.

**Cubic Foot** - A unit of wood totaling an area equal to 1 foot by 1 foot by 1 foot.

**Cultural** - A general term for operations undertaken to assist existing tree regeneration to promote the development of a forest crop, and to minimize damage to the remaining trees. Operations include precommercial thinning, removal of competing vegetation and animal damage control.

**Cultural Resources** - The remains of sites, structures, or objects used by humans in the past—historical or archaeological.

**Cumulative Effects** - Those effects on the environment which result from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

**d.b.h.** - (Diameter Breast Height) The diameter of a tree measured at 4 feet 6 inches above the ground on the uphill side of the tree.

**Deferred MPA** - A Multiple-Pair Area outside of reserved lands (used in Alternative E).

**Demography** - The study of populations, especially of growth rates and age structure.

## **Glossary**

**Designated Areas Managed Primarily for Spotted Owl Habitat** - A central element of each alternative presented in this environmental impact statement. While the amount of, location of, and standard and guidelines for designated areas vary by alternative, management of spotted owl nesting, roosting, and foraging habitat is the primary goal in these areas.

**Developed Recreation** - Recreation that requires facilities that, in turn, result in concentrated use of an area. Examples of developed recreation areas are campgrounds and ski areas; facilities in these areas might include roads, parking lots, picnic tables, ski lifts, and buildings.

**Direct Effects for Employment and Income** - Those effects that impact sectors either exporting processed wood products from the economic area or selling those products to final consumers. An example of direct employment would be people working in a sawmill.

**Dispersal** - The movement, usually one way, of plants or animals from their point of origin to another location where they may produce offspring. For spotted owls, dispersal refers to movement of juveniles in their first year away from their natal area.

**Dispersal Habitat** - The habitat, with its characteristic forest structure and composition, which is used by dispersing spotted owls.

**Dispersed Recreation** - A general term referring to recreation use outside developed recreation sites; this includes activities such as scenic driving, hiking, backpacking, hunting, fishing, snowmobiling, horseback riding, and cross-country skiing in primitive environments.

**Diversity** - The variety, distribution, and abundance of different plant and animal communities and species within an area.

**Douglas-Fir Type** - An association of tree species in which Douglas-fir is recognized as one of the principal species.

**Draft Environmental Impact Statement (DEIS)** - The draft statement of environmental effects which is required for major Federal actions under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

**Early-Successional Forest** - Forest seral stages younger than mature and old-growth age classes.

**Edge** - The interface between two or more different plant communities, forest successional stages, or forest structural conditions.

**Edge Effect** - The effect of adjoining vegetative communities on the population structure along the margin, which often provides for greater number of species and higher population densities of some species than either adjoining community. Edge may result in negative effects as well; habitat along an edge is different than in the patch of habitat, reducing the effective area of the habitat patch.

**Effective Population Size** - The number of males and females of an idealized population that interbreeds. Effective population sizes are typically half or less than half of census population size, because not all adults interbreed.

**Effects** - Effects, impacts, and consequences, as used in this environmental impact statement, are synonymous. Effects may be direct, indirect or cumulative and may fall in one of these categories: aesthetic, historic, cultural, economic, social, health or ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems).

**Endangered Species** - Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

**Environmental Analysis** - A comprehensive evaluation of alternative actions and their predictable short- and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions.

**Even-Age Management** - The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

**Even-Aged Stands** - Stands of trees from either natural (fire) or artificial (harvest) origin where the difference in age between trees forming the main canopy level usually do not exceed 20 percent of the age of the stand at harvest rotation age.

**Extinction Rate** - The number of elements (individuals, populations, species) lost per unit of time.

**Fecundity** - The number of female young produced per adult female per year.

**Final Environmental Impact Statement (FEIS)** - The final version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses to the draft.

**Fledgling** - A young, pre-dispersal bird which has left the nest.

**Floater** - Non-breeding adult or subadult spotted owls that move and live within a breeding population and which have the potential to replace members of breeding pairs.

**Forb** - A broad-leaved, herbaceous plant.

**Forest or Forest land** - Lands currently supporting or capable of supporting forests at a density of 10 percent crown closure or better.

**Forest Matrix** - Forest lands between designated areas managed primarily for spotted owl habitat (used in Alternatives B, C, and D).

## **Glossary**

**Forest Types** - A classification of forest land based upon the tree species presently forming a plurality of basal area stocking in live trees.

**FORPLAN** - A linear programming computer model used in forest planning.

**Fragmentation** - The process of reducing size and connectivity of stands that comprise a forest.

**Fuels** - Slash and other forest residue that can represent a fire hazard.

**Genetic Drift** - The occurrence of random changes in the gene frequencies of small isolated populations, not due to selection, mutation, or immigration.

**Genetic Variation** - The variety of genes present within and among individuals in the population which influences how well a population can adapt to environmental changes over time.

**Geographic Information Systems (GIS)** - A technology used for entering, storing, analyzing, updating, and retrieving spatial information.

**Habitat** - The place where a plant or animal naturally or normally lives or grows.

**Habitat Capability** - The estimated ability of an area, given existing or predicted habitat conditions, to support a wildlife, fish, or plant population. It is measured in terms of potential population numbers.

**Habitat Conservation Area (HCA)** - A contiguous block of habitat to be managed and conserved for breeding pairs, connectivity, and distribution of spotted owls; application may vary throughout the range according to local conditions (used in Alternatives B, C, and D).

**High Site** - An area with higher than average site class.

**Home Range** - The area to which the activities of an animal are confined during a defined period of time.

**IMPLAN** - A computer-based system used by the Forest Service for constructing nonsurvey input/output models to measure economic input. The system includes a data base for all counties in the United States and a set of computer programs to retrieve data and perform the computational tasks for input/output analysis.

**Inbreeding** - Mating or crossing of individuals more closely related than average pairs in the population.

**Incidental Take** - Under the Endangered Species Act, "any taking otherwise prohibited...if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." See also **Take**.

**Indicator Species** - A species which is indicative of a particular habitat, community, or environmental conditions, when it is present.

**Indirect Effects for Employment and Income** - Those that impact other production, trade, and service sectors that provide the production inputs needed to manufacture the processed wood products. An example of indirect employment would be people who manufacture the saw blades used in the sawmills.

**Induced Effects for Employment and Income** - Those that impact consumer spending within the economic area associated with jobs that support the direct and indirect production. An example of induced employment would be grocery store employees who sell products to the people working in sawmills or making saw blades.

**Ingrowth** - The period in time after successional growth of a forest stand when it reaches a specified age or structure class, for instance, spotted owl foraging habitat.

**Interdisciplinary Team** - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

**Juvenile** - A young, post-fledging bird in the first year of life.

**Knutson-Vandenberg Fund (KV Fund)** - The portion of timber sale receipts collected and used for reforestation and other renewable resource projects on the timber sale area.

**Late-Successional Forests** - Forest seral stages which include mature and old-growth age classes.

**Litter Layer** - The loose, relatively undecomposed organic debris on the surface of the forest floor made up typically of leaves, bark, small branches, and other fallen material.

**Long term** - With respect to the viability of the northern spotted owl, approximately a century or longer.

**Management Direction** - A statement of multiple use and other goals and objectives, and the associated management prescriptions and standards and guidelines for attaining them.

**Mature** - A contiguous stand of trees which, compared to old-growth stands, generally contains trees of a smaller size of less variable age distribution, and a stand which is less structurally complex and contains less dead woody material.

**MBF** - Thousand board feet.

**MCF** - Thousand cubic feet.

**Mitigation** - Mitigation includes: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and, (e) compensating for the impact by replacing or providing substitute resources or environments (40 CFR Part 1508.20).

## *Glossary*

**MMBF** - Million board feet.

**MMCF** - Million cubic feet.

**Model** - A representation of reality used to describe, analyze, or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations.

**Monitoring** - A process of collecting information to evaluate whether or not objectives of a management plan are being realized.

**Movement** - Shifts in locations of animals, which may be two-way such as seasonal movements, or one-way as in a shift to a new breeding territory.

**Multiple-Pair Areas (MPAs)** - A contiguous block of spotted owl habitat to be managed and conserved for breeding pairs, connectivity, and distribution of owls and, in the case of Research MPAs, owl-related research (used in Alternative E).

**Multi-Resource Strategy** - see Chapter 2, Alternative E; and Appendix K. The complete title is Multi-Resource Strategy for Conservation of the Northern Spotted Owl.

**Multistoried** - A stand of trees with more than one layer of vegetation as distinguished by vegetation height.

**Natal Area** - The nest tree and proximity of birth or hatching.

**National Environmental Policy Act (NEPA)** - An Act passed in 1969 to declare a National policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the Nation, and establishes a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, Agric. Handb. 453. USDA Forest Service, 359 p.).

**National Forest Management Act (NFMA)** - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Forest Plans and the preparation of regulations to guide that development.

**Nesting, Roosting, and Foraging Habitat** - The forest vegetation with the age class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the northern spotted owl.

**New Perspectives** - An approach to managing forests and rangelands to sustain their full array of values. New Perspectives focuses on leaving a larger portion of the timber sale area to meet wildlife habitat needs, improve esthetics, protect soil and water quality, maintain genetic resources, etc.

**Non-declining Flow** - Where the quantity of timber planned for sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade, and this planned sale and harvest for any decade is not greater than the long-term sustained yield capacity.

**Nonforest Land** - Lands that never have had or that are incapable of having 10 percent or more of the area occupied by forest trees; or lands previously having such cover and currently developed for nonforest use.

**Old-Growth Forest** - A forest stand with moderate to high canopy closure, a multilayered, multispecies canopy dominated by large overstory trees, a high incidence of large trees with broken tops and other indications of dead or dying trees, numerous large snags, and logs and other down woody material on the forest floor.

**Output** - A good, service, or on-site use that is produced from forest and rangeland resources.

**Overmature** - The stage at which a tree declines in vigor and soundness, for example, past the period of rapid height growth.

**Overstory** - That portion of the trees, in a forest or in a stand of more than one story, that forms the upper or uppermost canopy.

**Owl Management Zone** - All forested land areas outside of reserved areas or Multiple-Pair Areas, and lying between MPAs or adjacent to this central system of reserves and MPAs as delineated on the map (used in Alternative E).

**Packing** - A temporary influx of organisms of various sex and age classes into remaining suitable habitat as previously available habitat is changed to unsuitable conditions.

**Pair** - In this document, a male and female spotted owl that may or may not be breeding, and that share a common territory. In surveys pair is defined as two adult or subadult spotted owls observed within close proximity to each other, or one to two adults/subadults observed within close proximity to juvenile owls (confirmed reproduction) during the breeding season.

**Pair Site** - An amount of habitat that is considered capable of supporting one pair of spotted owls.

**Patch** - A contiguous area of forest of similar composition and structure.

**Persistence** - As in population persistence; term for the capacity of a population to maintain sufficient numbers and distribution over time.

**Physiographic Province** - A region having a particular pattern of plant communities due to effects of climate and geology which result in particular spotted owl numbers, distribution, and habitat-use patterns that differ significantly from those of adjacent regions.

**Planning Area** - In this document, the range of the northern spotted owl on National Forests.

## *Glossary*

**Planning Period** - One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits.

**Planning Records** - The body of information documenting the decisions and activities which result from the process of developing a Forest Plan, or revision or significant amendment to a Forest Plan.

**Population** - A group of individuals from the same species occupying a defined area, which interbreed and which are isolated to some degree from other similar groups.

**Population Density** - Number of individuals of a species per unit area.

**Population Structure** - The number of males and females in various age classes.

**Population Viability** - Probability that a population will persist for a specified period of time across its range despite normal fluctuations in population and environmental conditions.

**Precommercial Thinning** - The practice of removing some of the trees which are less than marketable size from a stand so that the remaining trees will grow faster.

**Prescribed Fire** - A wildland fire burning under specified conditions which will accomplish certain planned objectives. The fire may result from either planned or unplanned ignitions. Proposals for use of unplanned ignitions for this purpose must be approved by the Regional Forester.

**Present Net Value** - The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

**Presuppression** - Activities organized in advance of fire occurrence to ensure effective suppression action.

**Prey** - An animal or animals killed and consumed by another animal.

**Programmed Harvest** - The amount of timber on the forest that is scheduled for harvesting. The programmed harvest is based on current demand, funding, and multiple-use considerations.

**Receipts** - Those priced benefits for which money will actually be paid to the Forest Service: recreation fees, timber harvest, mineral leases and special use fees.

**Record of Decision** - A document separate from but associated with an environmental impact statement which states the management decision, identifies all alternatives including both the environmentally preferable and preferred alternatives, states whether all practicable means to avoid environmental harm from the preferred alternative have been adopted, and if not, why not.

**Recreation Opportunity Spectrum** - Land delineations that identify a variety of recreation experience opportunities categorized into six classes on a continuum from primitive to urban. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs, based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area, and the relative density of recreation use.

**Recreation Visitor Day** - A measure of recreation use, in which one Recreation Visitor Day equals 12 visitor hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.

**Reforestation** - The natural or artificial restocking of an area with forest trees.

**Regeneration** - The renewal of a tree crop, whether by natural or artificial means. Also, the young crop itself, which is commonly referred to as reproduction.

**Regeneration Cutting (Harvest)** - Harvest methods used where the objective is to replace all or part of the stand with new seedlings. This includes clearcutting, shelterwood, seed tree, and selection harvests.

**Region** - A Forest Service administrative unit. The two Regions affected by this proposed action are the Pacific Northwest Region (Region 6) which includes National Forests in Oregon and Washington, and the Pacific Southwest Region (Region 5) which includes National Forests in California.

**Regional Forester** - The Forest Service official responsible for administering a single Region.

**Regional Guide** - The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended (NFMA). Regional Guides provide standards and guidelines for addressing major issues and management concerns which need to be considered at the regional level to facilitate Forest planning.

**Regulations** - Generally refers to the Code of Federal Regulations, Title 36, Chapter II, which covers management of the Forest Service.

**Rescue Effect** - Periodic immigration of new individuals sufficient to maintain a population that might otherwise decline toward extinction.

**Research MPA** - A Multiple-Pair Area that will be utilized to evaluate silvicultural treatments on spotted owl habitat through designed research (used in Alternative E).

**Research Natural Area (RNA)** - An area set aside by a public or private agency specifically to preserve a representative sample of an ecological community, primarily for scientific and educational purposes. In Forest Service usage, Research Natural Areas are areas designated to ensure representative samples of as many of the major naturally-occurring plant communities as possible.

**Reserved Lands** - Lands in the National Forest that are reserved by law for special management such as Wilderness, National Monuments, and Wild and Scenic Rivers.

## Glossary

**Reserved MPA** - A Multiple-Pair Area within reserved lands (used in Alternative E).

**Restricted Harvest** - The action of apportioning the supply of a resource to specific uses or to particular persons or organizations.

**Riparian Area** - Geographically delineated areas with distinctive resource values and characteristics that are comprised of aquatic ecosystems, and ecosystems influenced by adjacent bodies of water.

**Roost** - The perch on which birds rest, as birds on a perch. To settle down to sleep.

**Rotation** - Planned number of years between the establishment of a generation of trees and its final harvest at a specified stage of maturity. Appropriate for even-aged management only.

**Sanitation** - The removal of dead or damaged trees, or trees susceptible to insect and disease attack such as intermediate and suppressed trees, essentially to prevent the spread of pest or pathogens and to promote forest health.

**Scheduled Timber Harvests** - Volumes and acres programmed for harvest which are within the allowable sale quantity. This does not include salvage and sanitation harvesting.

**Scoping Process** - A part of the National Environmental Policy Act (NEPA) process; early and open activities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an environmental impact statement.

**Second Growth** - Forest growth that has become established following some interference, such as cutting, serious fire, or insect attack, with the previous forest crop.

**Selection Cutting** - The annual or periodic removal of trees (particularly mature trees), individually or in small groups, from an uneven-aged forest, to realize the yield and establish a new crop of irregular constitution.

**Sensitive Species** - Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a significant current or predicted downward trends in population numbers or density; or a significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19)).

**Seral** - A biotic community which is at a developmental stage in transition in an ecologic succession.

**Shade-Tolerant Species** - A species that is able to grow satisfactorily in the shade of other trees.

**Shelterwood** - The cutting method that describes the silvicultural system in which, in order to provide a source of seed and/or protection for regeneration, the old crop (the shelterwood) is removed in two or more successive shelterwood cuttings. The first cutting is ordinarily the seed cutting, though it may be preceded by a preparatory cutting, and the last is the final cutting. Any intervening cutting is termed removal cutting. An even-aged stand results.

**Short term** - Approximately the next 50 years, with respect to viability of the northern spotted owl.

**Silviculture** - The art and science of controlling the establishment, composition, and growth of forests.

**Site Class** - A measure of the relative productivity capacity of a site for the crop or stand under study, based on volume or height (e.g., usually the height of the dominant or codominant trees) or the maximum mean annual growth increment that is attained or attainable at a given age.

**Site Preparation** - Manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire, or construction in order to encourage the growth of favored species. Site preparation may include the application of herbicides; burning or cutting living vegetation that competes with the favored species; tilling the soil; or burning organic debris (usually logging slash) that makes planting or seeding difficult.

**Site Productivity** - Production capability of specific areas of land.

**Slash** - The residue left on the ground after tree felling and tending, and/or accumulating there as a result of storm, fire, girdling or poisoning. It includes unutilized logs, uprooted stumps, broken or uprooted stems, the heavier branchwood, etc.

**Snag** - A standing dead tree.

**Spotted Owl Habitat Area (SOHA)** - A habitat area designated to support one pair of owls (used in Alternative A).

**Stage Classes** - Any distinguishable phase of growth or development of an organism.

**Stand (Tree Stand)** - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the forest in adjoining areas.

**Standards and Guidelines** - Principles specifying conditions or levels of environmental quality to be achieved.

**Stocking** - The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard; that is, the basal area or number of trees required to fully use the growth potential of the land.

**Stocking Control** - Work methods designed to control the amount or degree of site occupancy by trees as compared to specific management objectives (e.g., thinning, fertilization, underburning).

**Structural Diversity** - The diversity of forest structure, both vertical and horizontal, which provides for a variety of forest habitats, such as logs and multilayered forest canopy, for plants and animals.

## *Glossary*

**Subadult** - A young, post-dispersal bird in the second, or in some cases, second and third year of life.

**Subspecies** - A group of interbreeding natural populations, differing taxonomically and with respect to genetic characteristics, and often isolated geographically, from other such groups within a biological species, and interbreeding successfully with these groups where their ranges overlap.

**Substantive Comment** - A comment that provides factual information, professional opinion, or informed judgment germane to the action being proposed.

**Succession** - The ecological progression of community change over time, characterized by displacements of species, leading towards a stable climax community.

**Suitable (for Timber Production, also Selected Suitable)** - Commercial forest land identified as appropriate for timber production in the forest planning process.

**Sustained Yield** - The achievement and maintenance in perpetuity of a desired annual or periodic output of the various renewable resources of the National Forests without impairment of the land's productivity.

**Take** - From the Endangered Species Act (16 U.S.C. 1532): "To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect [any species protected under the Endangered Species Act], or to attempt to engage in any such conduct." See also **Incidental Take**.

**Technically Suitable** - Also **Tentatively Suitable** - Land physically capable of being managed for timber production.

**Territorial Single Owl** - An unpaired owl defending a territory.

**Territory** - The area that an animal defends, usually during breeding season, against intruders of its own species.

**Thinning** - Harvests or other cutting aimed at improving the growing conditions for the remaining trees.

**Thinning from Below** - The common type of thinning that favors the dominant trees, more or less evenly distributed over the stand, by removing a varying proportion of the other trees.

**Threatened Species** - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future as is defined in the Endangered Species Act. (See also **Endangered Species**.)

**Timber Management** - A general term for the directing, managing or controlling of forest crops and stands of trees.

**Timber Production** - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of forest planning, this term does not include production of fuelwood or harvest of unsuitable lands.

**Tolerant** - See **Shade-Tolerant Species**.

**Understory** - The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

**Uneven-Age Management** - A management regime that maintains multiple crown layers and age classes within a single stand. Cutting methods include single tree selection and group selection.

**Unsuitable (for Timber Production)** - Forest land withdrawn from timber utilization by statute or administrative regulation, land not capable of being managed for timber production, or land identified as not appropriate for timber production in the forest planning process.

**Viable Population** - A population which has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population on the planning area (FSM 1905).

**Wilderness** - Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. Wildernesses are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or a primitive and unconfined type of recreation; are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

**Wildfire** - Any wildland fire that is not a prescribed fire. (See also **Prescribed Fire**.)

**Yarding** - Hauling timber from the tree stump to a collection point.

**Yield Tables** - Tables that estimate the level of outputs that would result from implementing a particular activity. Usually referred to in conjunction with FORPLAN input or output. Yield tables can be developed for timber volumes, range production, soil and water outputs, and other resources.

## *Glossary*

This page left blank for notes.

---

## Bibliography



# Bibliography

---

Adams, D.M.; Haynes, R.W. 1980. The 1980 softwood timber assessment market model: structure, projections and policy simulations. *Forest Science*. 26(3), Monograph 22.

Adams, R.L. 1991. Economic analysis of mineral impacts of northern spotted owl critical habitat designation. In: *Economic analysis of designation of critical habitat for the northern spotted owl*. Washington, DC: USDI Fish and Wildlife Service. 33 p. Appendix C.

Ahr, P.; Gorodezky, M.J.; Dong Won Cho. 1981. Measuring the relationship of public psychiatric admissions to rising unemployment. *Hospital and Community Psychiatry* 32(6): 398-401. (Cited in Lee et al. 1991).

Almack, J., Personal Communication, Washington Department of Wildlife, Sedro Woolley, WA.

Anderson, D.R.; Bart, J.; Edwards, T.C., Jr.; [and others]. 1990. Status review: northern spotted owl *Strix occidentalis caurina*. USDI Fish and Wildlife Service. 99 p.

Anthony, R.G.; Isaacs, F.B. 1989. Characteristics of bald eagle nest sites in Oregon. *Journal of Wildlife Management*. 53(1): 148-159.

Armstrong, P.S.; Schulma, M.D. 1990. Financial strain and depression among farm operators: the role of perceived economic hardship and personal control. *Rural Sociology* 55(4): 475-493. (Cited in Lee et al. 1991).

Austin, K., Personal Communication, Oregon State University, Corvallis, OR.

Barling, P.W.; Handal, P. 1980. Incidence of utilization of public mental health facilities as a function of short-term economic decline. *American Journal of Community Psychology* 8(1): 31-39. (Cited in Lee et al. 1991).

Bart, J.; Forsman, E.D. [In press] (11/15/91). Dependence of northern spotted owls on old-growth forests. *Biological Conservation*.

Bartel, J., USDI Fish and Wildlife Service, Sacramento, CA.

Bellrose, F.C. 1980. *Ducks, geese and swans of North America*. Harrisburg, PA: Stackpole Books. 540 p.

Beuter, J.H. 1990. Social and economic impacts in Washington, Oregon and California associated with implementing the conservation strategy for the northern spotted owl: an overview. Washington, DC: American Forest Resource Alliance.

Bolsinger, C.L.; Jaramillo, A.F. 1990. *Taxus brevifolia*, Pacific yew. *Silvics of North America*. Volume 1-Conifers Agric. Handb. 654. Washington, DC: USDA Forest Service: 573-579.

Briar, K.H. 1988. Social work and the unemployed. Silver Springs, MD: National Association of Social Workers. (Cited in Lee 1990b.).

## Bibliography

Brown, E.R., tech. ed. 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. Publ. R6-F&WL-192-1985. Portland, OR: USDA Forest Service, Pacific Northwest Region. Part 1-Chapter narratives. Part 2-Appendix.

Brown, J.H.; Kodric-Brown, A. 1977. Turnover rates in insular biogeography: effects of immigration on extinction. *Ecology*. 58: 445-449.

Brown, T.C.; Richards, M.T.; Daniel, T.C. 1989. Scenic beauty and recreation value: assessing the relationship. In: Vining, J., ed. *Social science and natural resource recreation management*. Boulder, CO: Westview Press.

Buchanan, J.B. 1991. Spotted owl nest site characteristics in mixed conifer forests of the eastern Cascade mountains, Washington. Seattle, WA: University of Washington. M.S. thesis.

Bull, E.; Cooper, H. 1991. Vaux's swift nests in hollow trees. *Western Birds*. 22: 85-91.

Burget, A.M.; Danczyk, K.L. 1991. Non-timber effects of critical habitat designation. In: *Economic analysis of designation of critical habitat for the northern spotted owl*. Washington, DC; USDI Fish and Wildlife Service, Economic Analysis Team; draft. Appendix D. 6 p.

Call, M.W. 1978. Nesting habitats and surveying techniques for common western raptors. Technical Note TN-316. Denver, CO: USDI Bureau of Land Management.

Carey, A.B. 1991. The biology of arboreal rodents in Douglas-fir forests, In: Huff, M. H.; Holthausen, R.S.; Aubry, K.B., tech. coords. 1991. *Biology and management of old growth forests*. Gen. Tech. Rep. PNW-GTR-276. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 46 p.

Carey, A.B.; Biswell, B.L.; Witt, J.W. 1991. Methods for measuring populations of arboreal rodents. Gen. Tech. Rep. PNW-GTR-273. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 24 p.

Carroll, M. [In press]. *Community and the northwest logger*. Corvallis, OR: Oregon State University Press. (Cited in Lee 1990b).

Carter, H.R.; Erickson, R.A. 1988. Population status and conservation problems of the marbled murrelet in California, 1892-1987. Sacramento: California Department of Fish and Game; final report; contract FG7569. 68 p.

Cassirer, E.F.; Groves, C.R. 1991. Harlequin duck ecology in Idaho: 1987-1990. Boise, ID: Idaho Department of Fish and Game. 93 p.

Catalano, R.; Dooley, D. 1981. The behavioral costs of economic instability. *Policies Studies Journal*. 10(2): 338-349. (Cited in Lee et al. 1991).

Copper, L., Personal Communication, Oregon Department of Fish and Wildlife, Tygh Valley, OR.

## Bibliography

D'Arcy, C.; Siddique, C.M. 1985. Unemployment and health: an analysis of Canada Health Survey data. *International Journal of Health Services* 15(4): 609-635. (Cited in Lee et al. 1991).

Dawson, W.R.; Ligon, J.D.; Murphy, J.R.; Myers, J.P.; Simberloff, D.; Verner, J. 1986. Report of the advisory panel on the spotted owl. *Audubon Conserv. Report* 7. 46 p.

Diggles, M.F., ed. 1991. Assessment of undiscovered porphyry copper deposits within the range of the northern spotted owl, northwestern California, western Oregon, and western Washington. USGS open file Rep. 91-377. U.S. Geological Survey. 58 p.

Farrand, J., Jr., ed. 1983. *The Audubon Society guide to master birding*. New York: Alfred A. Knopf. 447 p. Vol. 1.

Fitchen, J. 1987. When communities collapse: implications for rural america in human services in rural environments 11(1): 48-57 (Cited in Lee et al. 1991).

Forsman, E.D., Meslow, E.C.; Strub, M.J. 1977. Spotted owl abundance in young versus old forests, Oregon. *Wildlife Society Bulletin* 5:43-47.

Forsman, E.D., Personal Communication, USDA Forest Service, Pacific Northwest Research Station, Forestry and Range Sciences Lab, Corvallis, OR.

Forsman, E.D.; Meslow, E.C.; Wight, H.M. 1984. Distribution and biology of the spotted owl in Oregon. *Wildl. Monogr.* 87: 1-64.

Fox, A. 1989. Timber supply in the Pacific Northwest: aggregate implications of forest plans. Portland, OR: USDA Forest Service, Pacific Northwest Region.

Franklin, A.B.; Ward, J.P.; Gutierrez, R.J.; Gordon, I.G., Jr. 1990. Density of northern spotted owls in northwest California. *J. Wildl. Manage.* 54: 1-10.

Franklin, J.F.; Spies, T.A. 1983. Characteristics of old-growth Douglas-fir forests. In: *Changes for wildlife and fish—the old-growth ecosystem in managed forests: Proceedings of the 1983 technical session of the Wildlife and Fish Ecology Working Group*. Society of American Foresters: 10-16.

Johnson, K.N.; Gordon, J.; Franklin, J.F.; Thomas, J.W. 1991. Alternatives for management of late successional forests of the Pacific Northwest: a report to the U.S. House of Representatives, Committee on Agriculture and Committee on Merchant Marine and Fisheries. Washington, D.C. Draft. 30 p.

Greber, B.J. 1991. Forest resource using industries of the Pacific Northwest. In: *Economic analysis of designation of critical habitat for the northern spotted owl*. Washington, DC: USDI Fish and Wildlife Service, Economic Analysis Team; draft. Appendix A. 49 p.

Greene, S. 1988. Research Natural Areas and protecting old-growth forests on federal lands in western Oregon and Washington. *Nat. Areas J.* 8: 25-30.

## Bibliography

Gunderson, G., Personal Communication, USDA Forest Service, Pacific Northwest Region, Portland, OR.

Gutierrez, R.J.; Ward, J.P.; Franklin, A.B. [and others]. 1985. Dispersal ecology of juvenile northern spotted owls (*Strix occidentalis caurina*) in northwestern California. Final Report - Cooperative Agreement, PNW-82-226, USDA Forest Service, Pacific Northwest Research Station. Arcata, CA: Humboldt State University Foundation. 48 p.

Hagen, D.A.; Vincent, J.W.; Welle, P.G. [1991]. The benefits of preserving old-growth forests and the northern spotted owl. Bellingham, WA: Western Washington University, Department of Economics.

Hamer, T.E., Personal Communication, Washington Department of Wildlife, Olympia, WA.

Hayes, D., Personal Communication, Washington Department of Wildlife, Olympia, WA.

Hibbard, M. 1986. Community beliefs and failure of community economic development. *Social Science Review.* (5): 184-200. (Cited in Lee et al. 1991).

Huebner, A.H. 1991. Demographic trends in California, Oregon, and Washington counties with northern spotted owl populations/habitat. Washington, DC: USDA Forest Service.

Haynes, R.W.; Adams, D.M. 1985. Simulations of the effects of alternative assumptions on demand-supply determinants on the timber situation in the United States. Washington, DC: USDA Forest Service, Forest Resources Economics Research.

Isaac, L.A. 1956. Place of partial cutting on old-growth stands of the Douglas-fir region. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station.

Johnson, D., Personal Communication, Oregon Department of Fish and Wildlife, Corvallis, OR.

Johnson, K.N.; Beuter, J.; Greber, B.; Lettman, G.; Sessions, J., 1990. Timber for Oregon's tomorrow—the 1989 update. Corvallis, OR: Oregon State University, College of Forestry, Forest Research Lab.

Kasl, S.; Gore, S.; Cobb, S. 1975. The experience of losing a job: reported changes in health symptoms and health behavior. *Psychosomatic Medicine.* 37(2): 51-59. (Cited in Lee et al. 1991).

Lawson, B.Z. 1987. Work-related post-traumatic stress reactions: the hidden dimension. *Health and Social Work.* (Fall): 250-258. (Cited in Lee 1990b, and Lee et al. 1991).

Lee, R.G. 1990a. Testimony prepared for a hearing of the Committee on Commerce and Labor of the Washington State House of Representatives, Olympia, WA, June 14, 1990.

Lee, R.G. 1990b. Social and cultural implications of implementing a conservation strategy for the northern spotted owl. Washington, DC: American Forest Resource Alliance.

## Bibliography

Lee, R.G.; Sommers, P.; Birss, H.; Nasser, C.; Zientek, J. 1991. Social impacts of alternative timber harvest reductions on Federal lands in O and C counties: Final Report for the Association of O and C Counties. Seattle, WA: College of Forest Resources and Northwest Policy Center, University of Washington.

Lehmkuhl, J.F.; Ruggiero, L.F. 1991. Forest fragmentation in the Pacific Northwest and its potential effects on wildlife. In: Ruggiero, L.F.; Aubry, K.B.; Carey, A.B.; Huff, M.H., tech. coords. *Wildlife and vegetation of unmanaged Douglas-fir forests: proceedings of a symposium; 1989 March 29-31; Portland, OR*. Gen. Tech. Rep. PNW-GTR-288. Portland, OR: USDA Forest Service, Pacific Northwest Research Station: 35-46.

Leschner, L.L.; Cummins, E.B. Breeding records, inland distribution, and threats of the marbled murrelet in Washington, 1905-1987. In: Carter, H.; Kiff, L., eds. [In Press]. *Status, distribution, and management of the marbled murrelet*. Los Angeles, CA: Proc. W. Foundation of Vertebrate Zoology.

Lifton, R.J.; Olson, E. 1976. The human meaning of total disaster: the Buffalo Creek experience. *Psychiatry* 399 (February): 1-19. (Cited in Lee et al. 1991).

Lincoln, R.J.; Boxshall, G.A.; Clark, P.F. 1982. *A dictionary of ecology, evolution and systematics*. Cambridge, Great Britain: Cambridge University Press. 298 p.

Linn, M.W.; Sandifer, R.; Stein, S. 1985. Effects of unemployment on mental and physical health. *American Journal of Public Health*. (Cited in Lee et al. 1991).

Lint, J., Personal Communication, USDI Bureau of Land Management, Roseburg, OR.

Lowe, R., Personal Communication, North Bend, OR.

Luchterhand, E. 1971. Sociological approaches to massive stress in natural and man-made disasters. In: Krystal, H.; Niederland, W.G., eds. *Psychic traumatization in individuals and communities*. Boston: Little Brown and Company: 29-33. (Cited in Lee et al. 1991).

Marcot, B.G., Personal Communication, USDA Forest Service, Pacific Northwest Range and Experiment Station, Portland, OR.

Marcot, B.G.; Holthausen, R.; Salwasser, H. 1986. Viable population planning. In: Wilcox, B.A.; Brussard, P.F.; Marcot, B.G. *The management of viable populations: theory, applications and case studies*. Stanford University, Center for Conservation Biology.

Marcot, B.G.; Holthausen, R. 1987. Analyzing population viability of the spotted owl in the Pacific Northwest. *Transactions of the 52 North American wildlife and natural resources conference*. Portland, OR: USDA Forest Service: 333-347.

Maser, C.; Tarrant, R.; Trappe, J.M.; Franklin, J., tech. eds. 1988. *From the forest to the sea: a story of fallen trees*. Gen. Tech. Rep. PNW-GTR-229. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 153 p.

## Bibliography

Maser, C.; Trappe, J.M., tech. eds. 1984. The seen and unseen world of the fallen tree. Gen. Tech. Rep. PNW-164. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 56 p.

Marshall, D.B. 1988. Status of the marbled murrelet in North America: with special emphasis on populations in Washington, Oregon, and California. USDI Fish and Wildlife Service. Biol. Rep. 88(30). 19 p.

Mays, L.K.; Mulder, B.S. 1991a. Letter dated July 28 to M.L. Plenert. On file with Spotted Owl EIS Team, Portland, OR.

Mays, L.K.; Mulder, B.S. 1991b. Letter with memo entitled, Responses to questions pertaining to interpretation and implementation of the Interagency Scientific Committee Conservation Strategy. Answers to questions in memo provided by members of the technical review team of the Interagency Northern Spotted Owl Conservation Group (NSOG). Memo dated April 29. Letter and memo on file with Spotted Owl EIS team.

McCorkle, D.V. 1980. Ecological investigation report: Oregon silverspot butterfly (*Speyeria zerene hippolyta*). USDA Forest Service, Siuslaw National Forest. 117 p.

McKelvey, K. 1991. A spatially explicit life-history simulator for the northern spotted owl. (Draft). Arcata, CA: USDA Forest Service, Pacific Southwest Experiment Station, Redwood Sciences Lab; preliminary report. 23 p.

Mehan, W.R., ed. 1991. Influences of forest and rangeland management of salmonid fishes and their habitats. Bethesda, MD: American Fisheries Society. 19: 751.

Miller, G.S. 1989. Dispersal of juvenile northern spotted owls in western Oregon. Corvallis, OR: Oregon State University, Department of Wildlife and Fisheries. 126 p. M.S. thesis.

National Geographic Society. 1983. Field guide to the birds of North America. Washington, DC: National Geographic Society. 464 p.

National Wildlife Federation. 1987. Grizzly bear compendium. Sponsored by the Interagency Grizzly Bear committee. C. Servheen project supervisor.

Nehlsen, W.; Williams, J.; Lichatowich, J. 1991. Pacific salmon at the cross-roads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries. 16(2): 4-21.

Nelson, S.K. 1990. Distribution of the marbled murrelet in western Oregon. Portland, OR: Oregon Department of Fish and Wildlife; final report. 46 p.

Nelson, S.K.; McAllister, M.L.C.; Stern, M.A. [and others]. The marbled murrelet in Oregon, 1899-1987. In: Carter, H.; Kiff, L., eds. [In Press]. Status, distribution, and management of the marbled murrelet. Los Angeles, CA: Proc W. Foundation of Vertebrate Zoology

Ogden, C., Personal Communication, Bureau of Indian Affairs, Portland, OR.

Oliver, C.D.; Larson, B.C. 1990. Forest Stand Dynamics. New York: McGraw-Hill.

## Bibliography

Page, F., Personal Communication, USDA Forest Service, Pacific Northwest Region, Portland, OR.

Paradiso, J.L.; Nowak, R.M. 1982. Wolves. In: Chapman, J.A.; Feldhamer, G.A., eds. Wild mammals of North America. Johns Hopkins Univ. Press: 460-474.

Paton, P.W.C.; Ralph, C.J. 1988. Geographic distribution of the marbled murrelet in California at inland sites during the 1988 breeding season. Sacramento: California Department of Fish and Game, Nongame Bird and Mammal Section; final report; job II.B.2. 35 p.

Plenert, M. 1990. Letter dated November 9 to members of the Interagency Northern Spotted Owl Conservation Group. On file with the Spotted Owl EIS Team, Portland, OR.

Polzin, P.E. 1990. The spatial distribution of wood products industries. Washington, DC: American Forest Resource Alliance.

Raphael, M.G., Personal Communication, USDA Forest Service, Pacific Northwest Range and Experiment Station, Olympia, WA.

Raphael, M.G. 1985. Administrative study of relationship between wildlife and old-growth forest stands. USDA Forest Service, Pacific Northwest Region; final report. 19 p. On file at Pacific Southwest Region, Regional Office.

Raphael, M.G. 1988. Long-term trends in abundance of amphibians, reptiles, and mammals in Douglas-fir forests of northwestern California. In: Szaro, R.C.; Severson, K.E.; Patton, D.R., tech. coords. Management of amphibians, reptiles, and small mammals in North America: Proceedings of a symposium; 1988 July 19-21; Flagstaff, AZ. Gen. Tech. Rep. RM-166. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 23-31.

Raphael, M.G.; Rosenberg, K.V.; Marcot, B.C. 1988. Large-scale changes in bird populations of Douglas-fir forests, northwestern California. In: Jackson, J.A., ed. Bird Conservation. Madison: Univ. Wisconsin Press. 3: 63-83.

Reynolds, R.T. 1979. Food and habitat partitioning among two groups of coexisting *Accipiter*. Corvallis, OR: Oregon State University. 116 p. Ph.D. thesis.

Ricker, W. 1972. Hereditary and environmental factors affecting certain salmonid populations. In: Simon, R.C.; Larkin, P.A., eds. The stock concept in Pacific salmon. Vancouver: Univ. British Columbia: 19-160.

Rose, S. 1991. Draft report on social costs of timber industry job losses in Washington State. Submitted to Governor Gardner's Timber Team. (Cited in Lee et al. 1991).

Rosenberg, K.V.; Raphael, M.G. 1986. Effects of forest fragmentation on vertebrates in Douglas-fir forests. In: Verner, J.; Morrison, M.L.; Ralph, C.J., eds. Wildlife 2000: modeling habitat relationships of terrestrial vertebrates: Proceedings of an international symposium; 1984 October 7-11; Fallen Leaf Lake, CA: Madison: Univ. Wisconsin Press: 263-272.

## Bibliography

Rubin, J; Helfan, G.; Loomis, J. [1991]. A benefit-cost analysis of the northern spotted owl: results from a contingent valuation survey. Davis, CA: Univ. California, Department of Environmental Studies.

Ruggiero, L.F., Personal Communication, USDA Forest Service, Rocky Mountain Range and Experiment Station, Laramie, WY.

Ruggiero, L.F.; Jones, L.L.C.; Aubry, K.B. 1991. Plant and animal habitat associations in Douglas-fir forests of the Pacific Northwest: an overview. In: Ruggiero, L.F.; Aubry, K.B.; Carey, A.B.; Huff, M.H. tech. coords. Wildlife and vegetation of unmanaged Douglas-fir forests: Proceedings of a symposium; 1989 March 29-31; Portland, OR. Gen. Tech. Rep. PNW-285. Portland, OR: USDA Forest Service, Pacific Northwest Research Station: 447-462.

Salwasser, Hal; Mealey, S.P.; Johnson, K. 1984. Wildlife population viability: a question of risk. North American Wildlife Natural Resource Conference. 49: 421-439.

Scherzinger, W. 1983. Beobachtungen an Woldkauz-Habichtskauz-Hybriden (*Strix aluco* x *Strix uralensis*). Zool. Garten N. S. 53: 133-148.

Schoenwald-Cox, C.M.; Chambers, S.M.; MacBryde, B.; Thomas, W.L. 1983. Genetics and conservation. Menlo Park, CA: Benjamin/Cummings Publ. Co. 722 p.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. BioScience. 31: 131-134.

Shaffer, M.L. 1983. Determining minimum viable population sizes for the grizzly bear. International Conference on Bear Resource Management. 5: 133-139.

Skaggs, R.W.; Ellis, D.H.; Hunt, W.G.; Johnson, T.H. 1986. Peregrine falcon. In: Glinski, R.L.; Pendleton, B.G.; Moss, M.B. [and others]. LeFranc, M.N., Jr.; Millsap, B.A.; Hoffman, S.W., eds. Proceedings of the southwest raptor management symposium and workshop. National Wildlife Federation: 127-136.

Southwood, T.R.E. 1966. Ecological methods. London: Methuan.

Speich, S.M.; Wahl, T.R.; Manual, D.A. [In press]. The number of marbled murrelets in Washington marine waters. Proc. West. Found. Vert. Zool.

Stalmaster, M.V.; Knight, R.L.; Holder, B.L.; Anderson, R.J. 1985. Bald eagles. In: Brown, E.R., ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. Publ. 6-F&WL-192-1985. USDA Forest Service, Pacific Northwest Region: 269-290.

Starkey, E., Personal Communication, USDI National Park Service, Oregon State University, Corvallis, OR.

Stearns, A. 1991. Owl memo #3: Interim policy and procedures for protecting the northern spotted owl in Washington. Policy statement to regional managers of Washington Department of Natural Resources, dated March 5. Olympia, WA: Washington Department of Natural Resources. 25 p. On file with: Spotted Owl EIS Team.

## Bibliography

Stebbins, R.C. 1954. Natural history of the salamanders of the plethodontid genus *Ensatina*. Univ. California Publications in Zoology. 54: 47-123.

Thomas, J.W.; Forsman, E.D.; Lint, J.B. [and others]. 1990. A conservation strategy for the northern spotted owl. Portland, OR: A report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. USDA Forest Service; USDI Bureau of Land Management, Fish and Wildlife Service, National Park Service. 427 p.

Thomas, J.W. 1991. Letter with memo entitled, Responses to questions pertaining to interpretation and implementation of the Interagency Scientific Committee Conservation Strategy. Answers to questions in memo provided by ISC Committee. Memo dated January 2. Letter and memo on file with Spotted Owl EIS team.

USDA Forest Service. 1988a. General water quality best management practices. USDA Forest Service, Pacific Northwest Region. 86 p.

USDA Forest Service. 1988b. Spotted owl guidelines. In: Final supplement to the environmental impact statement for an amendment to the Pacific Northwest regional guide. USDA Forest Service, Pacific Northwest Region. Vol. 1.

USDA Forest Service. [Unpublished]. Port-Orford-cedar action plan. USDA Forest Service, Pacific Northwest and Pacific Southwest Regions. 9 p.

USDA Forest Service. 1990a. List of proposed, endangered, threatened, and sensitive species (plants and animals). R-6 Interim Directive No. 90-1, FSM 2670.44. Portland, OR: USDA Forest Service, Pacific Northwest Region.

USDA Forest Service. 1990b. A strategic plan for the 90's: working together for rural America. USDA Forest Service, Washington, DC.

USDA Forest Service. 1991a. Questions and answers on: "A conservation strategy for the northern spotted owl." Portland, OR: USDA Forest Service, Pacific Northwest Research Station. Miscellaneous publication. February 1991. 63 p.

USDA Forest Service. 1991b. Economic effects of implementing the proposed designation of critical habitat for the northern spotted owl on national forests. Washington, DC: USDA Forest Service, Economic Effects Team (Tom Hamilton, Leader), June 5, 1991.

USDA Forest Service. 1991c. Economic effects of implementing the proposed designation of critical habitat for the northern spotted owl on national forests—an update of the June 5, 1991 analysis. Washington, DC: USDA Forest Service, Economic Effects Team (Tom Hamilton, Leader), October 15, 1991.

USDA Forest Service; USDI Bureau of Land Management. 1990. Economic effects of implementing a conservation strategy for the northern spotted owl. Washington, DC: Interagency Economic Effects Team.

USDI Bureau of Land Management. 1990. [Unpublished]. Northern spotted owl: the Jamison plan detailed management strategy. [Interim management guidelines for spotted owl management]. 12 p.

## Bibliography

USDI Fish and Wildlife Service. 1982. Pacific coast recovery plan for the American peregrine falcon. Portland, OR: USDI Fish and Wildlife Service. 87 p.

USDI Fish and Wildlife Service. 1986. Pacific bald eagle recovery plan. Portland, OR: USDI Fish and Wildlife Service. 160 p.

USDI Fish and Wildlife Service. 1987. The northern spotted owl status review. Portland, OR. 47 p.

USDI Fish and Wildlife Service. 1989. The northern spotted owl: a status review supplement. Portland, OR. 114 p.

USDI Fish and Wildlife Service. 1990a. Interim procedures leading to endangered species act compliance for the northern spotted owl. Portland, OR: USDI Fish and Wildlife Service. 37 p.

USDI Fish and Wildlife Service. 1990b. MacDonald's rockcress, (*Arabis macdonaldiana* Eastwood), recovery plan. Portland, OR: USDI Fish and Wildlife Service, Endangered Species Program, Region 1. 40 p.

USDI Fish and Wildlife Service. 1991. Guidelines for surveying proposed management activities that may impact northern spotted owls. Portland, OR: USDI Fish and Wildlife Service. 22 p.

U.S. Environmental Protection Agency. 1987. Nonpoint source controls and water quality standards. Water quality standards handbook: 2-25. Chapter 2.

Voous, K.H. 1988. Owls of the northern hemisphere. Cambridge, MA: The MIT Press. 320 p.

Walsh, R.G.; Johnson, D.M.; McKean, J.R. 1989. Issues in nonmarket valuation and policy application: a retrospective glance. Western Journal of Agricultural Economics. 14: 178-188.

Walsh, R.G.; Keleta, G.; Olienyk, J.P. 1981. Value of trees to residential property owners with mountain pine beetle and spruce budworm damage in the Colorado Front Range: report to the USDA Forest Service, Washington, DC Colorado State Univ., Department of Economics.

Washington Department of Wildlife. 1989. Working implementation plan for bald eagle recovery in Oregon and Washington. Olympia, WA: Bald eagle working team for Oregon and Washington.

Weeks, E.C.; Drencacz, S. 1983. Rocking in a small boat: the consequences of economic decline in rural communities. International Journal of Mental Health 12(1-2): 672-75. (Cited in Lee et al. 1991).

Whitelaw, E.; Niemi, E. 1990. Investing in dislocated families: developing a legislative program for timber-dependent communities and for dislocated workers and families in Oregon. Report submitted to Oregon Joint Interim Committee on Forest Products Policy. Eugene, OR: 184-200. (Cited in Lee et al. 1991).

## *Bibliography*

Williamson, R.L.; Twombly, A.D. 1983. Pacific Douglas-fir. In: Burns, R.M., tech. comp. Silvicultural systems for the major forest types of the United States. Agric. Handb. 445. Washington, DC: USDA Forest Service: 191 p.

## *Bibliography*

This page left blank for notes.



1022456529



1022456529